

HISTORY
WAR

WAR MACHINES



FIGHTER PLANES

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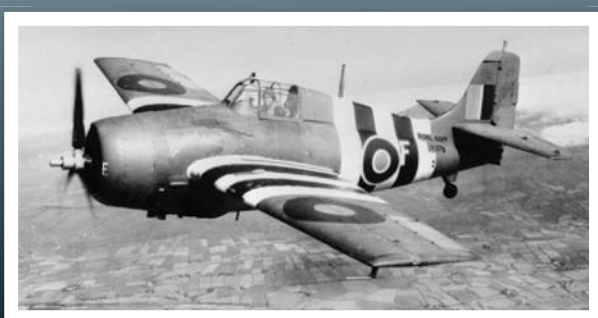
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Frontline

FIGHTER PLANES

Over 100 years of aerial combat has produced some of the most impressive and effective military technology

F-22 RAPTOR 1996

Country: **USA**

A SPEED FREAK WITH AN ARSENAL TO MATCH

This current generation of fighter aircraft is only operated by the United States Air Force – no other nation can purchase the plane under Federal law. Designed to operate as a stealth attack aircraft, the F-22 has seen action in the Gulf and is capable of achieving incredible speeds of around 1,500mph.



VICKERS FB 1914

Country: **UK**

THE UK'S FIRST FIGHTER PLANE

The Vickers was the first purpose-built fighter plane to be produced and was part of the world's first official fighter squadron. It came with two seats, a .303 Lewis gun and interestingly enough was only capable of speeds of around 70mph when at altitude.



POLIKARPOV I-15 1934

Country: **Soviet Union**

THE BACKBONE OF THE EARLY SOVIET AIR FORCE

The I-15 was used extensively from the 1930s to the mid-1940s by a selection of different nations. Flown by the Republicans during the Spanish Civil War, it remained in active service for many years, but was relegated to a ground-attack plane by 1941.



MESSERSCHMITT BF 109 1935

Country: **Germany**

**NAZI GERMANY'S ALL-CONQUERING
TECHNICAL MARVEL**

Perhaps the most-feared aircraft of the Second World War, the Bf 109 was the scourge of the skies on the Western Front. Early versions actually saw action during the Spanish Civil War, and over 30,000 had been produced by the end of the European theatre in 1945.



F-16 FIGHTING FALCON 1975

Country: **USA**

AMERICA'S MULTI-PURPOSE KILLER BIRD OF PREY

Used by a multitude of nations, the F-16 became one of the most widely deployed attack aircraft in the final decades of the 20th Century. The fighter has enjoyed varying military applications since its inception, and carries with it a fearsome arsenal for engaging targets at sea, on land or in dogfights.

SOPWITH CAMEL 1916

Country: **UK**

AN ICON OF THE SKIES OVER WWI EUROPE

A staple of the Royal Flying Corps during the First World War, the Sopwith Camel is perhaps the best-known aircraft of that era. Credited with a large number of confirmed kills, it became the most-prolific aircraft in Britain's arsenal, despite claims it was extremely difficult to fly.



TORNADO 1979

Country: **UK**

STURDY BRITISH ENGINEERING AT ITS BEST

The Tornado was designed with both reconnaissance functionality and combat versatility in mind, with an array of features that enable it to perform effectively in all weather conditions, whether during the day or at night. It has seen action all over the world, notably during the First Gulf War.



5 Facts about FIGHTER PLANES

HESS TAKES FLIGHT

In 1941, deputy Führer Rudolph Hess hopped into a Bf 110 and flew to Scotland in an apparent attempt to open talks with Great Britain. The tail-end of his aircraft is on display at the Imperial War Museum.

DEATH FROM ABOVE

The monstrous GAU-8 cannon utilised by the A-10 Warthog generates so much recoil that if it weren't mounted off-centre it would actually pull the plane off course while firing.

WINGING IT

In 1983 an Israeli pilot actually managed to land his F-15 despite it only having one wing. Apparently he was unaware of the extent of the damage that had been done to his plane.

OUTNUMBERED AND OUTGUNNED

During the Second World War, an American P-51 fighter managed to hold off around 30 German fighters that were attempting to down a flight of B-17s. This lasted for over half an hour.

THE PLANE OF THE FUTURE

The Eurofighter Typhoon attack aircraft is so advanced that it requires a series of computers to keep it airborne – a human being cannot pilot the Typhoon without their support.



The Eurofighter Typhoon can reach a maximum velocity of Mach 2.0

FIGHTER ACES



In the fierce battlefields among the clouds, only the most skilled, intuitive and fearless pilots emerged victorious

MANFRED VON RICHTHOFEN

THE WORLD'S MOST INFAMOUS AVIATOR

Years active: 1911-1918

Victories: 80

Regiment/Force: Luftstreitkräfte

Many will know Richthofen by his enduring moniker, 'The Red Baron', and his accomplishments in the air that still resonate today. This is a man that downed 22 enemy planes in the space of one month in 1917, and crafted for himself a fearsome reputation that spread fear among rival air forces of the time.

Born in Germany to a prominent aristocratic family, Richthofen spent his formative years serving as a military cadet, joining a cavalry unit after coming of age. When the war broke out, Richthofen was required to participate down on the brutal, bloody frontline as a cavalry reconnaissance officer. It wasn't long before

he found himself in the air where he belonged, and after time spent as an observer – during which he still reportedly downed an enemy aircraft with a machine gun – he began to make a name for himself as the first real flying ace. He eventually earned around 80 aerial victories by his death.

The Fokker Dreidecker was a formidable machine in the early era of the dogfight



LYDIA LITVYAK

SAT BEHIND THE CONTROLS OF A YAK-1 WITH THE WEIGHT OF THE WORLD ON HER SHOULDERS, LYDIA LITVYAK BROKE ALL THE RULES

Years active: 1941-1943

Victories: 11

Regiment/Force: Soviet Air Forces

Following Germany's decision to attack the Soviet Union in 1941, Lydia Litvyak tried to join the military in the hope of becoming a pilot. She was denied her request, yet was undeterred. After lying about how many hours in the air she had chalked up, she was accepted into the 568th Fighter Regiment, which was formed entirely of female pilots. Despite the decidedly dishonest approach, her determination was representative of a generation of people that would happily put themselves in danger in order to defend their country.

After being accepted into the unit, Litvyak began her arduous training in the cockpit of a Soviet Yak-1, and in the summer of 1942 embarked on her first combat mission. It was the first of many, and by the time of her death Lydia Litvyak had 11 confirmed victories to her name, much to the dismay of the surviving

German pilots that she downed. She earned her first kills in the skies way above the maelstrom at Stalingrad in 1942, becoming the first female pilot to achieve a confirmed kill.

She's an enduring figure of military history – a person that at that time went against what was expected of her as a woman, and excelled fully where hundreds of her male counterparts failed. As a pilot she achieved what most could only dream of, and as a woman she bucked any prejudices that she faced and arguably outshone the rest of the Soviet Air Force. She also remains one of only two solo female aces, along with her friend Katya Budanova.

Litvyak's fate is unclear – many people claim that she was killed in 1943, yet modern research into her loss hints at her having been captured by the Nazis and sent to a PoW camp. There is even evidence to suggest that she survived the war and moved to Switzerland, where she raised a family. Certainly, she was shot down – supposedly during the infamous Battle of Kursk.





RENÉ PAUL FONCK

THE RURAL BOY WHO JUST WANTED TO BE AN ENGINEER

Years active: **1914-1918**

Victories: **75**

Regiment/Force: **Armée de l'Air**

Born in north-eastern France in the late 19th Century, Fonck was originally rejected from flying duty and instead assigned to the combat engineers when he was conscripted. However, in 1915, Fonck was accepted for flight training, and before long he was terrorising the Germans in the skies above Europe, claiming his first victory in 1916.

As he began to participate in various combat missions against Germany, Fonck put his prior knowledge – he'd received his education in engineering – to good use in the air, demonstrating a thorough understanding of aircraft capabilities and a tremendous eye for shooting. Fonck's deadly precision when firing resulted in a kill tally of 75 confirmed, making him among the highest scoring pilots of the First World War and earning him a solid reputation as a deadeye that endures to this day.

ERICH ALFRED HARTMANN

THE MAN WITH THE MOST AERIAL KILLS OF ALL TIME

Years active: **1940-1945**

Victories: **352**

Regiment/Force: **Luftwaffe**

Some records are so impeccable that they're unlikely to ever be broken, no matter how much time passes. Hartmann's record is one of these, having scored an enormous 352 victories over Soviet and American pilots during the Second World War while flying his

Messerschmitt Bf-109. Baron von Richthofen may be the more-famous German pilot ace, but Hartmann's record is so astounding it's hard to believe he isn't a more prominent figure.

Known as 'The Black Devil' among his enemies, Hartmann achieved his first victory in the winter of 1942, downing a Russian IL-2 Sturmovik fighter-bomber. His tactics in battle involved attacking enemy aircraft from near enough point-blank range, favouring ambush and the subsequent chaos rather than longer-ranged fighting – he was even known to dive straight through enemy formations and delighted in getting up-close and personal.

At the end of the war in Europe, Hartmann and his squadron were captured and Hartmann himself was falsely convicted of war crimes by the Russians, eventually spending ten years in captivity. He died peacefully in 1993.



JALIL ZANDI

THE HIGHEST SCORING PILOT TO HAVE FLOWN THE F-14 TOMCAT

Years active: **1970-2001**

Victories: **11**

Regiment/Force: **Islamic Republic of Iran Air Force**

The preferred air superiority fighter of the USA for many years, the F-14 Tomcat had an amazing record of service, with several of the jets sold to Iran when US-Iran tensions were low. As the Iran-Iraq war broke out in 1980, the Iraqis were fielding around 600 air-ready jet fighters to conduct air-to-air combat and provide ground support, including MiGs and Su-22s.

Jalil Zandi has been credited with 11 total victories over this



fearsome opposition, all scored in an F-14 Tomcat, making him the most successful combat pilot in the history of the aircraft. Despite this, however, he was sent to prison for allegedly being disloyal to the Iranian regime, but was soon freed at the behest of his superiors. Zandi died in 2001 but will live on as one of only a small handful of modern jet aces.

JOSEPH MCCONNELL JR

A HERO OVER KOREA AND STILL THE HIGHEST-SCORING AMERICAN JET PILOT

Years active: **1942-1954**

Victories: **16**

Regiment/Force: **USAF**

After scoring his first victory on 14 January 1953, McConnell found himself an ace only a month later following his fifth victory over a MiG-15. He is known to have flown three different F-86 Sabres throughout his military career – each one named 'Beauteous Butch' (his wife's nickname was Butch) – and scored a total of 16 victories during the Korean War in the early 1950s.

It's amazing that a record set in the 1950s still stands today – no other American jet pilot has downed as many planes

in the history of jet-powered aviation, even with all of the advances in technology that have shaped modern air forces today. McConnell was unfortunately killed during a training exercise back on home soil while testing an F-86H, yet his memory lives on as the first and foremost of history's heroes of jet aviation.



WILLIAM AVERY BISHOP

THE BRITISH EMPIRE'S HIGHEST-SCORING PILOT

Years active: **1915-1918**

Victories: **70**

Regiment/Force: **Royal Flying Corps**

Ontario-born William Bishop landed in England in 1915 as a member of the 14th Battalion, Canadian Mounted Rifles. After serving in the trenches, waiting for an available space in the Royal Flying Corps' training program, he eventually transferred as an observer. Seated in the two-man R.E.7 reconnaissance aircraft, armed with only a single machine gun and a camera, Bishop served as an observer on the front lines for four months, before injury and illness saw him return to Canada.

His military career could easily have ended

there without note, but after returning to England in 1916 he entered flight training and the next year entered his first dogfight and was promoted to Flight

Commander. During WWI he clocked up over 70 confirmed enemies downed, and was heralded in his native Canada as a hero.



ANATOMY OF A... SPITFIRE

STICK AND CONSOLE

As with all aircraft, the console enabled the pilot to monitor their air speed, altitude, fuel levels and more. Fuel was a particularly important concern, as levels were kept fairly low so as to not impinge on the plane's speed or agility. Early models could only last 15 minutes of combat before having to return to base.

To this day the Spitfire is known across the globe as both a formidable weapon and a symbol of Britain's triumph in the skies

ROLLS-ROYCE MERLIN ENGINE

This is where the power lay, and what many credit for boosting the Spitfire above its competition – the supercharged engine. Having such strength underneath the hood gave the Spitfire the edge when it came to speed, and enabled incredible climbs without the risk of stalling.

NOSE AND PROPELLER

By the end of the Second World War the Spitfire had enjoyed 13 different propeller designs. Despite inconsistencies in the design, though, the spinner and propeller setup was adopted by default.

GLYCOL HEADER TANK

20MM CANNON

The two wing-mounted cannons were only equipped with 60 rounds each, meaning that the pilot had to be especially careful not to waste ammunition – 60 rounds was only enough for around 30 seconds of cumulative fire.

METAL BODY

The main body of the aircraft was designed to be hardy, but also to only incur low drag for combat manoeuvres. A skeleton of compound frames made up the fuselage in what was quite a complicated design. It featured a skin that was part of the plane's structure, rather than just a covering.

DRUM MAGAZINE

SUPERMARINE SPITFIRE

YEARS IN USE: 23

COUNTRY OF ORIGIN: GREAT BRITAIN

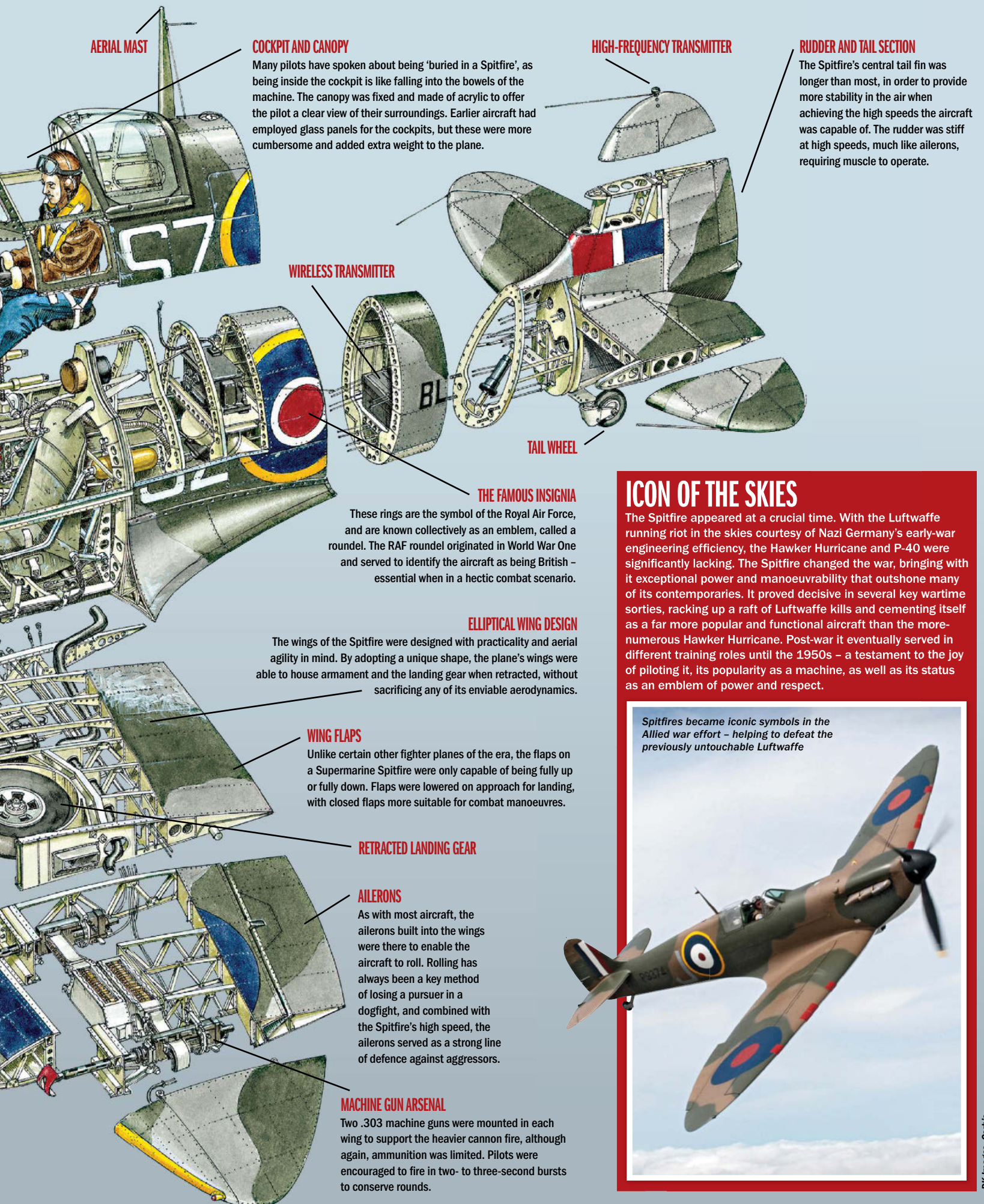
ENGINE SIZE: 1,470HP

WEIGHT: 2,300KG (LOADED)

LENGTH: 9.12M

TOP SPEED: 362MPH

WEAPONS: 2X 20MM CANNON, 4X .303 MACHINE GUNS



ICON OF THE SKIES

The Spitfire appeared at a crucial time. With the Luftwaffe running riot in the skies courtesy of Nazi Germany's early-war engineering efficiency, the Hawker Hurricane and P-40 were significantly lacking. The Spitfire changed the war, bringing with it exceptional power and manoeuvrability that outshone many of its contemporaries. It proved decisive in several key wartime sorties, racking up a raft of Luftwaffe kills and cementing itself as a far more popular and functional aircraft than the more-numerous Hawker Hurricane. Post-war it eventually served in different training roles until the 1950s – a testament to the joy of piloting it, its popularity as a machine, as well as its status as an emblem of power and respect.

Spitfires became iconic symbols in the Allied war effort – helping to defeat the previously untouchable Luftwaffe

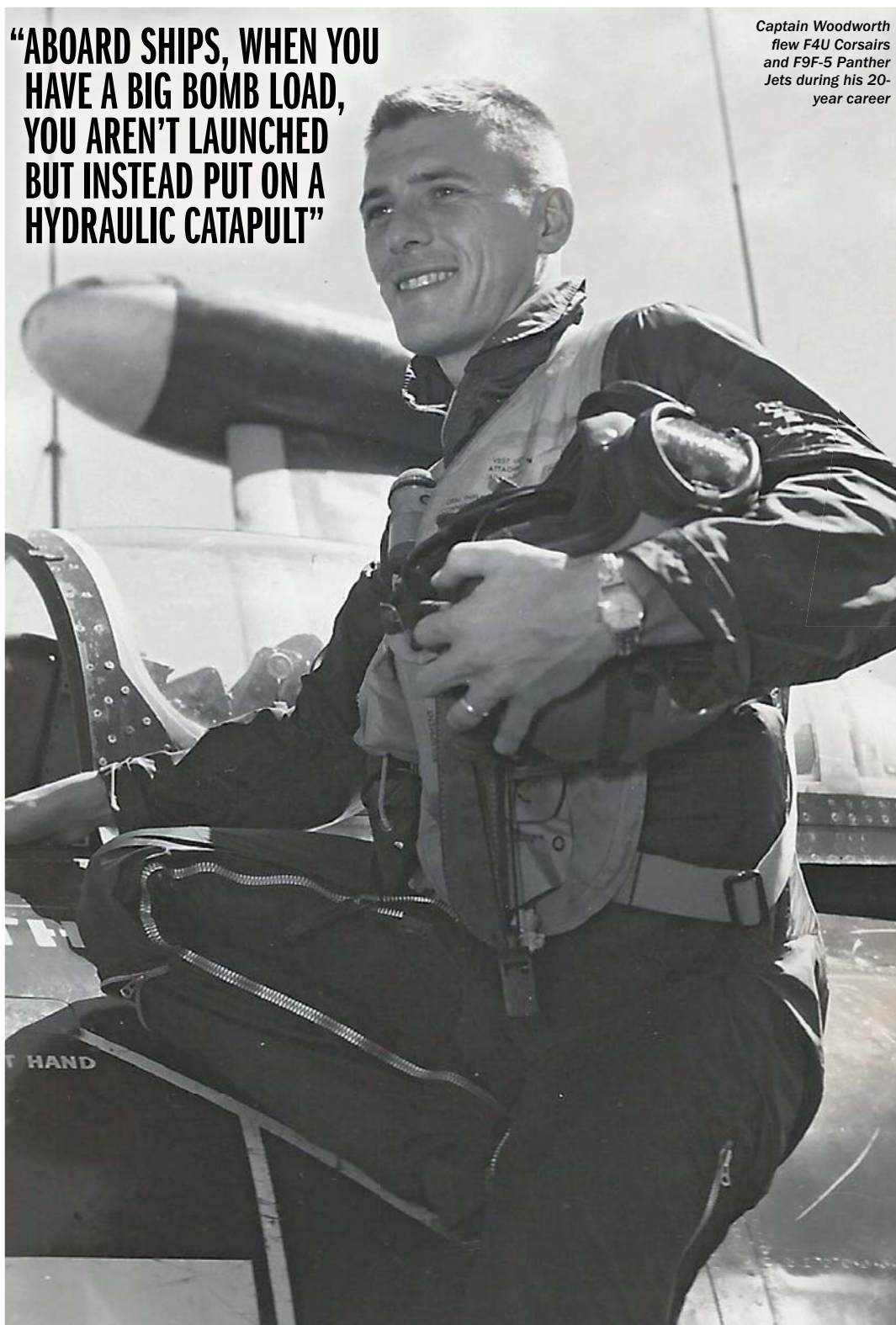


WAR IN THE SKIES OF KOREA

Korean War veteran Charles “Chuck” M Woodworth discusses his experiences in the air and the switch from propeller to jet engines

“ABOARD SHIPS, WHEN YOU HAVE A BIG BOMB LOAD, YOU AREN’T LAUNCHED BUT INSTEAD PUT ON A HYDRAULIC CATAPULT”

Captain Woodworth flew F4U Corsairs and F9F-5 Panther Jets during his 20-year career



Serving on the USS Philippine Sea, Captain Woodworth piloted F4U Corsairs in the danger and uncertainty of the Korean skies.

Here we speak with the US Navy veteran about MiG-15s, hydraulic launch catapults, his transition from propeller to jet power and even sneaking in an extra year of Navy service!

CAN YOU DESCRIBE THE FEELING OF BEING IN A KOREAN WAR-ERA FIGHTER PLANE?

Awesome! I flew an F4U Corsair and at the time it felt like being in the back of a big Cadillac. It was 13 feet [four metres] from your cockpit to the front with a 28,000hp engine and all sorts of guns and rockets at your disposal. It's a massive machine. When the Korean War started I was going through flight training and I was selected to go in the Corsair in Korea.

WHAT WAS YOUR COMBAT ROLE?

I was in Strike Fighter Squadron 113 in airgroup 11 on the USS Philippine Sea. Technically we were fighters but actually were more like attack-bombers because we didn't have anybody to fight with! The western half of the Korean Peninsula was for the Air Force while the eastern half was for the Navy. The MiGs seldom came to bother the Navy.

WHAT WAS THE CORSAIR LIKE AS A MACHINE? WAS IT EASY TO HANDLE? DID IT BREAK DOWN MUCH?

They were very good planes, very reliable. They came out at the end of the Second World War and they were very dangerous then because they had what was called torque roll. The engines were so big on the Corsair that when you came in to land there was a chance you would do a flip and end up upside down. To stop this, they added one more blade to the propellers. Aboard ships, when you have a big bomb load, you aren't launched but instead put on a hydraulic catapult. It was safer but could on occasion knock the electronics off and two or three times I lost

my radio and had to communicate using just simple hand signals.

WHY DID YOU CHOOSE TO JOIN THE US NAVY INSTEAD OF THE AIR FORCE?

During World War II I was in high school and I graduated in 1943. In order to get into officer training, they provided a test. On the top of the paper on the first page you had to circle A for Army or N for Navy. I already had a mind to be in the Navy after seeing pictures of them in the war. So I took the test and ended up at flight training!

DID YOU EVER HAVE TO MAKE A HASTY LANDING ANYWHERE OR EVEN WORSE, A CRASH LANDING?

No. I was very lucky! I flew a lot of missions and had 34 years in the Navy but never had a crash landing. At times I've had very poor visibility and strong winds at sea where the deck was going up and down by 25-30ft [7.5-9m]. The most dangerous, I guess, was on the frontline but we didn't go there too often. The Army or Marines would call us in to drop napalm on targets.

The Corsair was an effective and capable fighter-bomber



Strike Fighter Squadron 113 – Captain Woodworth is seen here third from the right on the front row

YOU HAD TO MAKE THE TRANSITION FROM PROPELLER-POWERED PLANES TO JET PLANES – WHAT WAS THE DIFFERENCE LIKE?

I flew F9F-5 Panther Jets off the Philippine Sea in Korea but never saw combat in them as the armistice was about to be signed. After a couple of years of flying and instructing in jets, I started flying heavy attack bombers until I finished my career in the Navy and began working at the Pentagon.

DID YOU SERVE AFTER THE KOREAN WAR?

Yes, I continued after the war in the Navy. I flew a lot of carrier aircraft but didn't see combat again. I served in Vietnam as a commander and the targeting centre for B-52 bombers was in my office. The Navy was generally on the sidelines, though, as the Air Force took over the targeting facilities. I also worked in the Pentagon in strategic analysis and war gaming.

WHEN DID YOU LAST FLY?

Well I'm 89 years old so they won't let me fly any more! I got out of the navy in 1977 and 52 years old or 20 years of service is the maximum age and time you can fly in the navy. I sneaked in 21 before they caught me!

MISTAKING THE ENEMY

HOW FRIENDLY FIRE NEARLY DOWNED TWO US AIRCRAFT

"Half of Korea was for the Navy and half for the Air Force. The Air Force had a lot MiG activity and sent up F-86s to intercept them," Captain Woodworth. "One day I was out with about 35 planes and we were near the bomb line with a lot of flak hitting us. We were dropping napalm and bombs and then all of a sudden somebody shouted 'MiGs!' and 35 planes went to full power and charged our guns. We pointed them at two sleek silver planes coming out of the Sun, which we couldn't quite make out. As we got closer with our guns aimed directly at the two planes, somebody shouted, 'F-86s, hold your fire!' The poor guys from the Air Force didn't realise how close they were to being blasted out of the sky by a huge squadron of planes carrying 2,400 rounds in six .50 calibre machine guns. That was an exciting moment. I was ready to start shooting MiGs but there were none on that day."



The Soviet MiG-15 and US F86 Sabre helped usher in the era of jet fighters and were even similar in appearance



HEAD TO HEAD

Only 11 years after the first ever powered flight, British, French and German pilots were engaged in a new type of warfare, flying their newly developed fighter planes in the French skies

GERMAN PILOT

DEUTSCHE LUFTSTREITKRÄFTE,
FOKKER DR.I

TRAINING

German pilots underwent three months of training before taking to the skies and were well drilled by the time they saw frontline service.

HANDLING

The extra wing gave the triplane good handling credentials and was much easier for beginner pilots to fly than the Camel.

WEAPONS

The MG08 machine gun was a dangerous weapon that was in military use on both the ground and up in the air until the 1960s.

TOP SPEED

The Fokker's top speed of 165km/h (103mph) meant it could outpace many enemy fighters in battle.

ENGINE

Flight was still in its early stages during the war, so the range was only 300km (186 miles) using an Oberursel air-cooled rotary engine.

TOTAL



“The Fokker DR.I was a Dreidecker triplane that struck fear into the hearts of the Royal Flying Corps and the Armée de l’Air”

FOKKER DR.I

The Fokker DR.I was a Dreidecker triplane that struck fear into the hearts of the Royal Flying Corps and the Armée de l’Air. In 1917, the year it was introduced, the German Luftstreitkräfte struck down over 200 enemy aircraft while only losing 66 of its own. This was down to the Germans’ superior Fokker and Albatros planes, which made mincemeat of the British Airco DH.2 and Factory F.E.8.

Unfortunately for the Germans, this jolted the RFC into action with the new Sopwith Camel Squadron. The most famous Fokker pilot was none other than The Red Baron, Manfred von Richthofen, who scored over 80 victories during the war.





BRITISH PILOT

ROYAL FLYING CORPS, SOPWITH CAMEL

TRAINING

A British pilot's training would only take 30 hours as pilots were rushed into the war in the early days of aviation.

TOP SPEED

A top speed of 185km/h (115mph) ensured the biplane could chase down the enemy Fokkers and the Albatros D.III in a dogfight.

HANDLING

Notoriously tricky to handle, the Sopwith was one of the best when flown by an experienced pilot, but tricky for a rookie.

ENGINE

The 130-horsepower Clerget 9B 9-cylinder rotary engine gave the Camel a range of 485km, which meant it could do battle for longer.

WEAPONS

The Sopwith Camel had twin 30-calibre Vickers machine guns fitted to blast down the opposition over the Western Front.

TOTAL



“One of the best British fighter aces in the war was Albert Ball who downed 45 enemy planes”



SOPWITH F-1 CAMEL

By 1917, the German airforce was in a dominant position in the battle over the skies of France. New fighters such as the Albatros D.III and the Fokker E.I had outclassed the obsolete British and French fighters in what was to be known as the 'Fokker Scourge'.

The Triple Entente fought back with a new fleet of aircraft including the Sopwith Camel, which boasted increased firepower and manoeuvrability that could match their German rivals. One of the best British fighter aces in the war was Albert Ball who downed 45 enemy planes and was awarded the Victoria Cross for his efforts.



Frontline

FIGHTER PLANES OF THE WORLD

We salute the most-iconic fighters from around the globe

1 LARGEST EVER DOGFIGHT

SYRIA 9 JUNE 1982

Nearly 200 fighter jets from Israel and Syria take to the skies and become embroiled in the largest air battle of all time. 80 Syrian planes are shot down.



Curtiss P-40

Produced: 1938

Speciality: **Air superiority and ground attack**
Location: **USA**



JAS 39 Gripen

Produced: 1988

Speciality: **Strikes and recon**
Location: **Sweden**



VL Myrsky

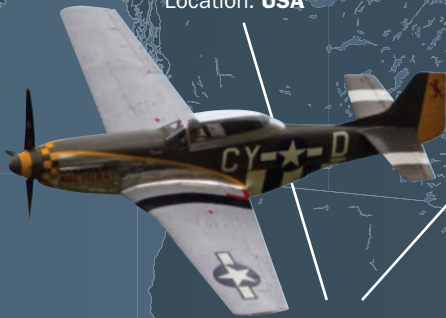
Produced: 1941

Speciality: **Combat manoeuvres**
Location: **Finland**

P-51 Mustang

Produced: 1941

Speciality: **High-speed attack fighter**
Location: **USA**



AV-8B Harrier II

Produced: 1978

Speciality: **V/STOL strike aircraft**
Location: **United Kingdom**



Dassault Mirage

Produced: 1967

Speciality: **Ground attack fighter**
Location: **France**



Fiat CR.42

Produced: 1938

Speciality: **Single-seat biplane**
Location: **Italy**

IAR 80

Produced: 1941

Speciality: **Ground attack aircraft**
Location: **Romania**



F2H Banshee

Produced: 1947

Speciality: **Carrier-based jet fighter**
Location: **USA**



F-14 Tomcat

Produced: 1969

Speciality: **Long-range interceptor**
Location: **USA**



Atlas Cheetah

Produced: 1986

Speciality: **All-round strike aircraft**
Location: **South Africa**



2 RAIDING OCCUPIED FRANCE

DIEPPE, FRANCE 19 AUGUST 1942

As part of a major Allied counter-offensive into occupied France, 74 aerial squadrons support ground troops during the Dieppe Raid. It's a failure, with scores of Spitfires and Hurricanes lost.

3 SOVIET AIR SUPERIORITY

NORTH KOREA 12 APRIL 1951

Three squadrons of MiGs attack a flight of American B-29s in the midst of the Korean War without any Soviet losses. An embarrassed USAF christens the event Black Thursday.



MiG-29

Produced: **1977**

Speciality: **Short-range dogfighter**

Location: **Soviet Union**



HESA Saeqeh

Produced: **2004**

Speciality: **Air battles and bombing runs**

Location: **Iran**

Shenyang J-11

Produced: **1998**

Speciality: **Air superiority fighter**

Location: **China**



4 BRITISH HARRIERS ATTACK

FALKLAND ISLANDS 5 MAY 1982

Three Sea Harriers from HMS Hermes launch a key attack on the Argentine airfield at Goose Green on the Falkland Islands with cluster bombs and 1,000lb bombs. One aircraft is lost to anti-aircraft fire.



Ford Island was the epicentre of the Pearl Harbor attack

5 JAPAN STRIKES THE US

HAWAII 7 DECEMBER 1941

The Imperial Japanese Navy launches a surprise aerial attack on the US naval base at Pearl Harbor, sinking four Navy battleships and directly pressuring the US into intervening in the Second World War.

6 WWI AIR BATTLE

ST. MIHIEL, EASTERN FRANCE

12 SEPTEMBER 1918

British and French planes take to the skies over France to engage Germany in one of the first major air-to-air battles of all time.

Mitsubishi A6M Zero

Produced: **1939**

Speciality: **Long-range dogfighter**

Location: **Japan**



7 CIVILIANS UNDER FIRE

ZHONGSHAN, CHINA

24 AUGUST 1938

A Douglas DC-2, the Kweilin, is shot down over China by Japanese aircraft. There are three survivors of what is considered the first instance of a civilian liner being downed by a fighter plane.

8 DESERT STORM

IRAQ 17 JANUARY 1991

The first air-to-air victories of the First Gulf War are achieved. Two patrolling American F-15s shoot down and destroy two enemy Iraqi-operated MiG-29s. This is one of the first actions of Operation Desert Storm.



The Gulf War Allies send hundreds of planes into Iraq

ANTI-AIRCRAFT WEAPONS

Get to grips with the weaponry that has been the scourge of aircraft since military aviation began

As the First World War rumbled on, aircraft and airships became a major part of warfare. The devastating effects of aerial reconnaissance, dogfighting and air raids meant a new wave of anti-aircraft weaponry was essential. The first anti-aircraft guns were no more than long-range machine guns, but as time progressed, more-advanced projectiles were fashioned to bring down groups of bombers and fighters. In modern warfare, anti-aircraft weaponry is still essential and with the advent of missile and laser defences, even stealth aircraft can now be brought down from the skies.

QF 3 INCH 20 CWT

Developer: United Kingdom

Era: 1914-1946

Projectile: 76.2 mm shells

Range: 4,900m (16,000ft)

The first weapon to be produced solely for anti-aircraft purposes, (prior to this gun, simple converted field and coastal guns were used) the QF 3 was a turning point in anti-aircraft technology.

Mounted on trucks, ships and emplacements, the gun proved effective both in mainland Europe and back home in Britain. It was so useful that it saw action in World War II as well.



S-75 DVINA

Developer: USSR

Era: 1957-present

Warhead: SAM missile with continuous fragmentation warhead

Range: 30km (19 mi)

Famous for shooting down Francis Gary Powers in his U-2 spy plane, the S-75 is the most widely distributed missile system in the world and helped usher through the age of missile defence. It uses a hi-tech guideline system and if the Cold War had got nastier, it could have easily blasted a B-52 bomber out of the sky.

S-75s are used by over 30 countries and are responsible for the downing of more American aircraft than any other missile.

RAPIER

Developer: United Kingdom **Era:** 1971-present

Warhead: MK-2 Fragmentation missile **Range:** 8.2km (5.1 miles)

One of the most technologically advanced anti-aircraft systems in existence; the Rapier is a portable all-weather guided weapon system. Capable of targeting two aircraft at once, its range is shorter than most modern systems but it makes up for this with the sheer power of its supersonic Mach 2 missiles and its laser blindfire tracking radar.



FLAK GUN

Developer: Nazi Germany

Era: 1936-1945

Projectile: 88mm shells

Range: 14,860m (48,753ft)

Coming in various sizes, the Flak ranged from 20mm to 128mm versions. These huge cannons were secretly constructed in the inter-war period and proved to be very effective in the defence of the Third Reich against the Allied onslaught. Light and with a rapid rate of fire, they were installed to protect important sites and outposts – a variant was even used to equip the formidable Tiger II tank.

FLAK BELTS

By 1942, 15,000 guns in 20km- (12mi-) thick defensive 'belts' of Flak protected occupied Europe.



CREW

88mm Flak guns required four men, while the larger 128mm armaments were run by a whole company of Wehrmacht soldiers.

WAR MACHINES: FIGHTER PLANES



***BACK 'EM UP
WITH MORE METAL***

SOPWITH

'Pup' was initially a nickname due to the fighter's small size, but it stuck and later took over from the official 'Scout' title

SOPWITH PUP (N6452)

ROLE: SINGLE-SEAT FIGHTING SCOUT

YEARS IN SERVICE: 1916-17

LENGTH: 5.9M (19FT 3.75IN)

WINGSPAN: 8.1M (26FT 6IN)

MAXIMUM SPEED: 179.4KM/H (111.5MPH)

MAXIMUM ALTITUDE: 5,334M (17,500FT)

ENGINE: 59.65KW (80HP) LE RHONE ROTARY ENGINE

ARMAMENT: VICKERS .303 MACHINE GUN, LEWIS MACHINE GUN (ON SOME MODELS), LE PRIEUR ROCKETS

PUP

Take a tour of the aircraft that brought the fight to the Germans and helped end the terror of the Fokker Scourge

WORDS JACK GRIFFITHS

The Pup was one of Sopwith's most iconic designs



"IT WAS A FIXED-GUN, SINGLE-SEAT FIGHTER AND ENTERED SERVICE IN 1916 TO TAKE THE WAR IN THE SKIES OF FRANCE BACK TO THE GERMANS"



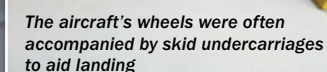
Above: A Pup taking off from the battle cruiser HMS Repulse in the pre-aircraft carrier era

The precursor to the Sopwith Camel and the SE5, the Pup was one of the Royal Flying Corps' (RFC) finest aircraft in the middle stages of World War I. It was not an original design, and its shape stems from its bigger brother the Sopwith 1½ Strutter, but it was instantly effective. The plane was a fixed-gun single-seat fighter and entered service in 1916 to take the war in the skies of France back to the Germans.

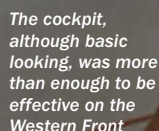
1,770 Pups were built in total, and were used extensively on the Western Front as aviation became an important part of warfare for the first time. The plane fast became a favourite among pilots due to its responsive controls and manoeuvrability, but was phased out in late 1917 as German fighters such as the Albatros DIII began to outclass it.

In the latter stages of the war the Pup was handed a new responsibility: protecting

Britain from the threat of Zeppelin raids. Fitted with more-powerful engines, they helped shield the skies from the German Empire's bombing attacks under Operation Türkenkreuz. After the war, Pups acted as training craft for pilots in the newly created RAF. Today they remain an iconic aircraft, and a fond reminder of the nascent period of military aviation. Very few aircraft are remembered with such nostalgia.



The aircraft's wheels were often accompanied by skid undercarriages to aid landing



The cockpit, although basic looking, was more than enough to be effective on the Western Front

COCKPIT

The aircraft's original design was supposedly sketched out in chalk on a Kingston shop floor by test pilot Harry Hawker. Nevertheless, the Pup possessed flying qualities above many of its contemporaries. The control was smooth and the .303 Vickers machine gun was attached to an interrupter gear, so that it could be fired forward through the plane's propeller.

Overheating was a common problem found with Vickers guns, but holes were cut into the water jacket so air could cool the weapon faster. The simple design of the Pup, in its role as a fighter scout, became the template that later Sopwith variations would follow. In the early days of military aviation, new and upgraded prototypes were rolling off the production line at a rapid rate. As such, it wasn't long until the Pup was superseded by more-improved models that were poised to take to the skies over France.

"IN THE EARLY DAYS OF MILITARY AVIATION, NEW AND UPGRADED PROTOTYPES WERE ROLLING OFF THE PRODUCTION LINE AT A RAPID RATE"

LE RHONE ENGINE

The 59.65kW (80hp) Le Rhone rotary engine helped the Pup achieve a rate of climb of 3,048 metres (10,000 feet) in 14 minutes. Excellent agility gave the RFC aircraft the upper hand over many of its rivals in the Luftstreitkräfte and helped end the Fokker Scourge of 1916, where German planes were outclassing their British counterparts in the skies.

Emerging later in the war, the heavier and larger Sopwith Camel was much harder to pilot than the Pup, but was more rewarding when control of the aircraft was mastered. As the Pup's role changed from the Western Front to home defence, the aircraft were fitted with more powerful 74.56kW (100hp) engines, which gave them an even better rate of climb. As well as being effective in the RFC, the Pup operated in the air services of many commonwealth countries as well as Russia and the USA.



The Le Rhone wasn't just confined to the Pup and was used in the Sopwith Camel as well as the enemy Fokker DR1 Triplane

THE PRE-AIRCRAFT CARRIER AGE

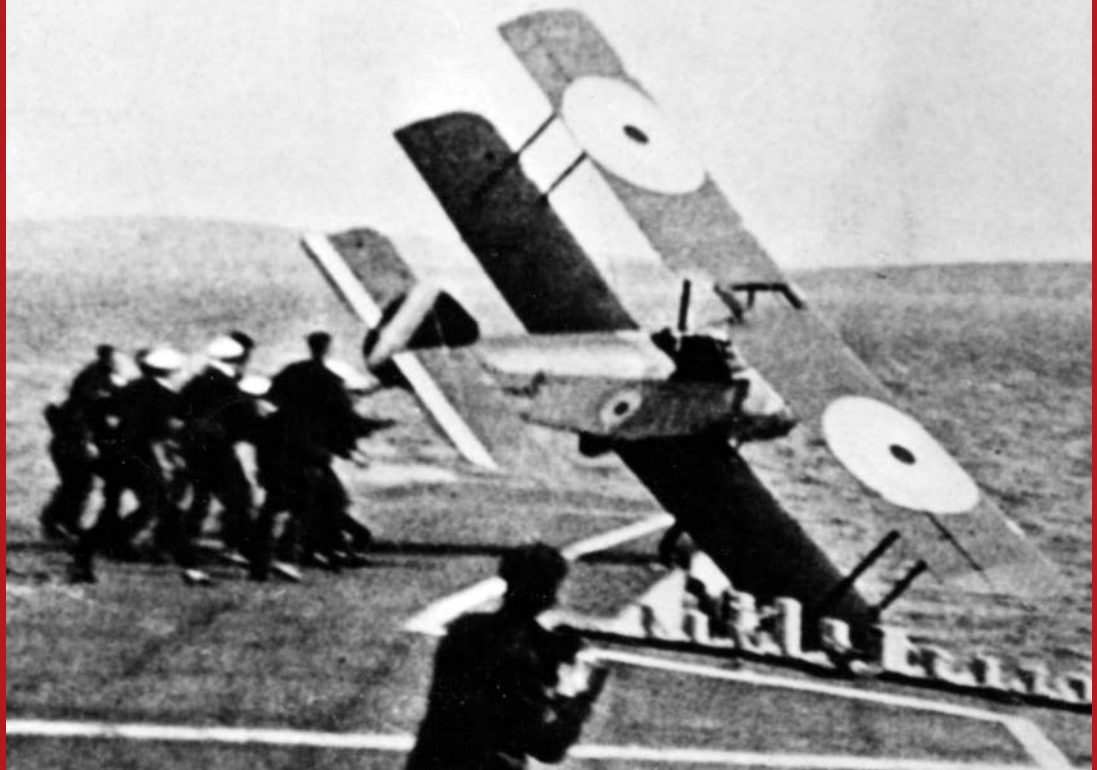
HOW THE PUP BECAME THE FIRST PLANE TO LAND ON A MOVING SHIP

As well as proving itself on the Western Front, the Sopwith Pup shot to fame with its excellent ability to land. Fitted with skid undercarriages, the fighter was designed to catch the traps set up on the decks of ships. On 2 August 1917, it became the first aircraft to achieve the feat when Lieutenant Commander Edwin Dunning successfully landed on the flying deck of battle cruiser HMS Furious.

Dunning was successful in landing at sea once again on 7 August, but he was not to be so lucky on his third attempt. As he approached the Furious, the engine choked and the lieutenant commander tried to pull out. However, it was too late, and the heavy landing burst a tyre as an updraft threw the plane overboard. Dunning was thrown about in the cockpit and knocked unconscious. He drowned in the sinking aircraft.

Right: Dunning's untimely death was shocking, but he had shown that landings could be made at sea, changing the face of aviation

"FITTED WITH SKID UNDERCARRIAGES, THE FIGHTER WAS DESIGNED TO CATCH THE TRAPS SET UP ON THE DECKS OF SHIPS"



DESIGN

To aid visibility, a portion of the top wing's centre section was cut out. Each wing had ailerons and raked tips to help the control and stability of the Pup. The top speed and rate of climb was aided significantly by the light yet tough structure of the aircraft.

When the Pup was reassigned to defensive duties, extra armament was included on top of the standard Vickers gun. Four Le Prieur rockets were attached to either wing and fired at the zeppelins that were appearing over London. Due to their inaccuracy, none of the rockets managed to bring down a zeppelin outright, but they did inflict damage and were effective in grounding enemy observation balloons. The rockets were replaced by incendiary bullets towards the end of the war.

The Pup may look basic and a little flimsy, but it was tough and packed with the latest in aviation technology

An early incendiary weapon, Le Prieur rockets were used to bring down German observation balloons and zeppelin airships



A SOPWITH PUP PILOT

The uniform of an RFC pilot was based on comfort, protection and warmth. A thick leather overcoat and scarf were worn at all times to protect from the cold as well as chafing from the wind. Goggles and a flying helmet were a necessity in an open cockpit as all sorts of debris could fly into the pilot's face. Tough boots were also a must to withstand the wear and tear of piloting a Pup.

“GOGGLES AND A FLYING HELMET WERE A NECESSITY IN AN OPEN COCKPIT”



"THE TOP SPEED AND RATE OF CLIMB WAS AIDED SIGNIFICANTLY BY THE LIGHT YET TOUGH STRUCTURE OF THE AIRCRAFT"



The Pup's whole engine casing rotated as only the crank remained stationary

Right: A single-seat fighter, the Pup had a wooden frame covered in canvas



THE SOPWITH ZOO

THE DOMINATION OF THE SOPWITH AVIATION COMPANY IN BRITAIN'S WAR IN THE SKIES

Founded by Thomas Octave Murdoch Sopwith, the aviation company started off small but soon grew into one of the chief designers of World War I aircraft. In just eight years the company employed 3,500 people in 14 acres of factories. 25 per cent of the British aircraft flown in World War I were Sopwith designs with 60 per cent of all single-seat aircraft being made by the company. After the war, Sopwith couldn't capitalise on its monopoly in the industry and failed to adjust to the lack of peacetime demand for fighter planes. By 1920, the company was no more.



Above: An experimental design, the Sopwith Triplane was only built in small numbers but was nevertheless effective against the German Fokkers
Above, right: Equipped with two Vickers .303 machine guns and highly manoeuvrable, the Camel came into its own after coming into combat service in June 1917
Right: The Strutter was a pioneering design and was the first British fighter to include a synchronised machine gun on board



Images: Alamy, Mary Evans

WAR MACHINES: FIGHTER PLANES

A kamikaze attack on carrier USS Belleau Wood off the coast of Luzon left a fire that killed 92 crewmen



THE DIVINE WIND OF DEATH

Inside the culture of sacrifice and nationhood
behind Japan's kamikaze pilots

WORDS MIGUEL MIRANDA

They called it the Pacific War. Barely three years after the spectacular success at Pearl Harbor, the Imperial Japanese Navy (IJN) was on its last legs. From Midway to Palau, Japan suffered losses – carriers, cruisers, submarines, planes and men – that couldn't be replaced even with the utmost effort to maximise industrial production.

In the last quarter of 1944, any remaining hope for victory over the Allies was brutally quashed. On 12 October, US Army aircraft clashed with the Japanese planes stationed on Formosa, and more than 300 Japanese planes were lost, denying air cover for the garrisons in the Philippine Islands.

The latest intelligence revealed that a vast American armada was steaming towards Leyte Gulf unopposed. There weren't enough combat aircraft to block an amphibious landing, and it would take days before two flotillas that had been sent from Singapore and Japan arrived. Desperate times, as the saying goes, called for desperate measures.

On 17 October, the same day the US Sixth Army began its assault on Leyte, Vice Admiral Takijiro Onishi set foot in Luzon, the Philippines' main island. The brash air-power advocate who once lobbied for an all-carrier IJN fleet was taking command of the battered 1st Air Fleet based in Mabalacat Airfield.

A week later, on the morning of 25 October, Japanese A6M Zeros from the 201st Air Group came in low and fast over Leyte Gulf. The previous day's missions had been difficult and inconclusive, but now the sun was out and the American carriers were exposed just off Tacloban, Leyte's capital.

These were escort carriers – basically large hulls supporting broad wooden decks loaded with fighters. They were first used in the Atlantic to hunt U-boats; in the Pacific, they became indispensable for air cover during landings. Escort carriers were so prolific that US shipyards built more than 120 of them, and they were in production until the war's end.

The Zeros each carried a 500-pound bomb and pilots were determined to sink their targets even as the tracers from incoming AA guns menaced them. The squadron leader, Lieutenant Yukio Seki, was killed together with his men, their planes blown to fiery bits.

However, Lieutenant Seki was skilled enough to crash his plane on the USS St Lo's runway, his payload detonating below deck. It was a nightmare to behold: acrid black smoke engulfed the flat top as its crew abandoned ship. St Lo took 113 men with it to the bottom of the sea. Its sister carriers USS Santee, Kitkun Bay and Suwannee suffered hits too. This was a shocking new type of war.

**“IF ONLY WE MIGHT FALL
LIKE CHERRY BLOSSOMS IN THE SPRING –
SO PURE AND RADIANT!”**

– Haiku of an unknown kamikaze pilot

TRAINING FOR THE TOKKO TAI

BY EARLY 1945, THOUSANDS OF YOUNG MEN WERE BEING RECRUITED AND 'VOLUNTEERED' FOR A CAMPAIGN OF UNRELENTING AERIAL SUICIDE ATTACKS

With the Philippine Islands lost, Japan's generals and admirals were worried about an impending American sprint across the Pacific toward the mainland. To thwart this possibility, they envisioned dedicated special attack squadrons of suicide aircraft called 'tokubetsu kôgeki tai' or 'Tokko Tai' for short.

Tokko Tai formally became a new branch of the Army and Navy Air Corps in March 1945, after US forces captured Iwo Jima. The concept of suicide flights really began with an experimental weapon, the Ohka, but officers like Vice Admiral Onishi showed how planes excelled at the same role. It was during the battle for Okinawa that US intelligence picked up a new term from Japanese propaganda broadcasts: kamikaze. It recalled the tempest that annihilated Kublai Khan's invasion of Japan in the 13th century.

Young men, with or without flying experience, were given the choice to volunteer for the Tokko Tai if they were already enlisted. Many others, usually undergraduates still in university, were drafted. On multiple occasions, officers who volunteered were denied simply because their skills would be put to better use training the would-be kamikazes. Tokko Tai pilots weren't brainwashed to venerate death, however. It was made perfectly clear their actions were a last resort. At its peak in the summer of

1945, Tokko Tai pilots were only given 30 hours of flight training in airfields outside the town of Chiran, in Kagoshima Prefecture.

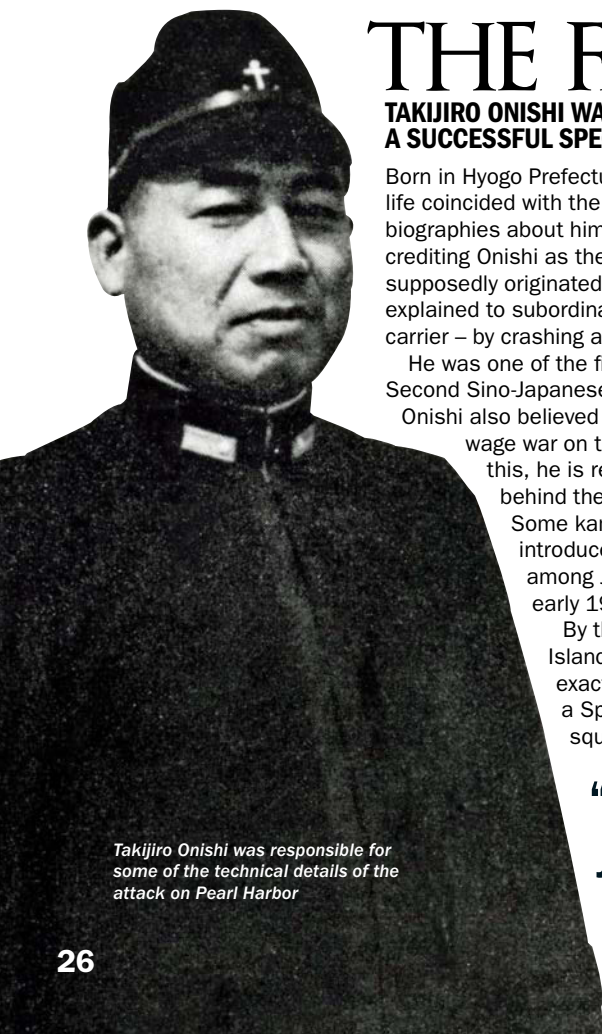
If a mission was aborted, the Tokko Tai manual instructed that a pilot "should be jovial and without remorse" upon his return. Tokko Tai pilots flew with no special equipment or designation. Before flying, they scribbled a haiku, sipped from a cup of whiskey and tied a white hachimaki round their heads.

The excellent A6M Zero manufactured by Mitsubishi Heavy Industries, along with many older planes, was used indiscriminately in the Philippines and Okinawa. The ideal kamikaze tactic was to skim the waves as they neared an American warship. The coup de grace was to climb and then dive towards the area between the bridge and the smokestacks. In their last seconds of consciousness, it was suggested that pilots scream "hissatsu!" (meaning 'certain kill') to hasten a doomed ship's destruction.

Sentimentality also mattered for Tokko Tai pilots. Their manual told them to remember their mothers as they perished. Upon dying, they were assured "all the cherry blossoms at Yasukuni shrine in Tokyo will smile brightly at you." In practice, hundreds of kamikazes were lost crashing into the water rather than their intended targets.



Members of 72nd Shinbu Squadron. They flew kamikaze attacks the next day



THE FATHER OF KAMIKAZE

TAKIJIRO ONISHI WAS A VETERAN PILOT CREDITED AS THE FIRST OFFICER TO ORGANISE A SUCCESSFUL SPECIAL ATTACK ON ALLIED FORCES

Born in Hyogo Prefecture on 6 June 1891, Takijiro Onishi's life coincided with the rise of Imperial Japan. Detailed biographies about him are very scarce and few go beyond crediting Onishi as the 'Father of Special Attack'. This supposedly originated from an unconventional tactic he explained to subordinates for crippling a US Navy aircraft carrier – by crashing a bomb-laden plane into it.

He was one of the first IJN fighter aces during the Second Sino-Japanese War (1937-45). A staunch patriot, Onishi also believed that it was unsound for Japan to wage war on the United States of America. Despite this, he is recognised as one of the planners behind the surprise attack on Pearl Harbor. Some kamikaze writers suggest Onishi was introduced to the concept of self-sacrifice among Japanese pilots in either 1943 or early 1944.

By the time he arrived in the Philippine Islands, Onishi had new orders – from exactly who is unknown – to organise a Special Attack operation using the squadrons of the 1st Air Fleet.

Like many of his peers, Onishi harboured serious doubts about the effectiveness of Special Attack tactics. It was particularly disturbing for an officer with his background, given his expert grasp of modern air combat.

Onishi kept his misgivings to himself. Like the rest of the IJN in 1944, he was gripped by a determination to do anything for the Japanese cause, more so with the Allies drawing near in ever greater numbers.

Onishi's personal conduct during the campaign to reconquer the Philippine Islands is unknown. But the Tokko Tai tactics he devised were still being carried out well into 1945 by IJN holdouts in the Philippines, with disappointing results. Back in Tokyo, Onishi knew, at least privately, that Special Attack tactics were squandering lives.

The architect of kamikaze met a terrible end. Hearing of the emperor's surrender message over the radio, the disheartened Onishi committed seppuku, or ritual suicide. But in a macabre twist, he was found a day later, on 16 August, writhing in agony. Having disembowelled himself with a knife, he was unable to slit his throat and refused a swift decapitation from a second. He lingered for hours before finally dying.

"HE WAS GRIPPED BY A DETERMINATION TO DO ANYTHING FOR THE JAPANESE CAUSE, MORE SO WITH THE ALLIES DRAWING NEAR"

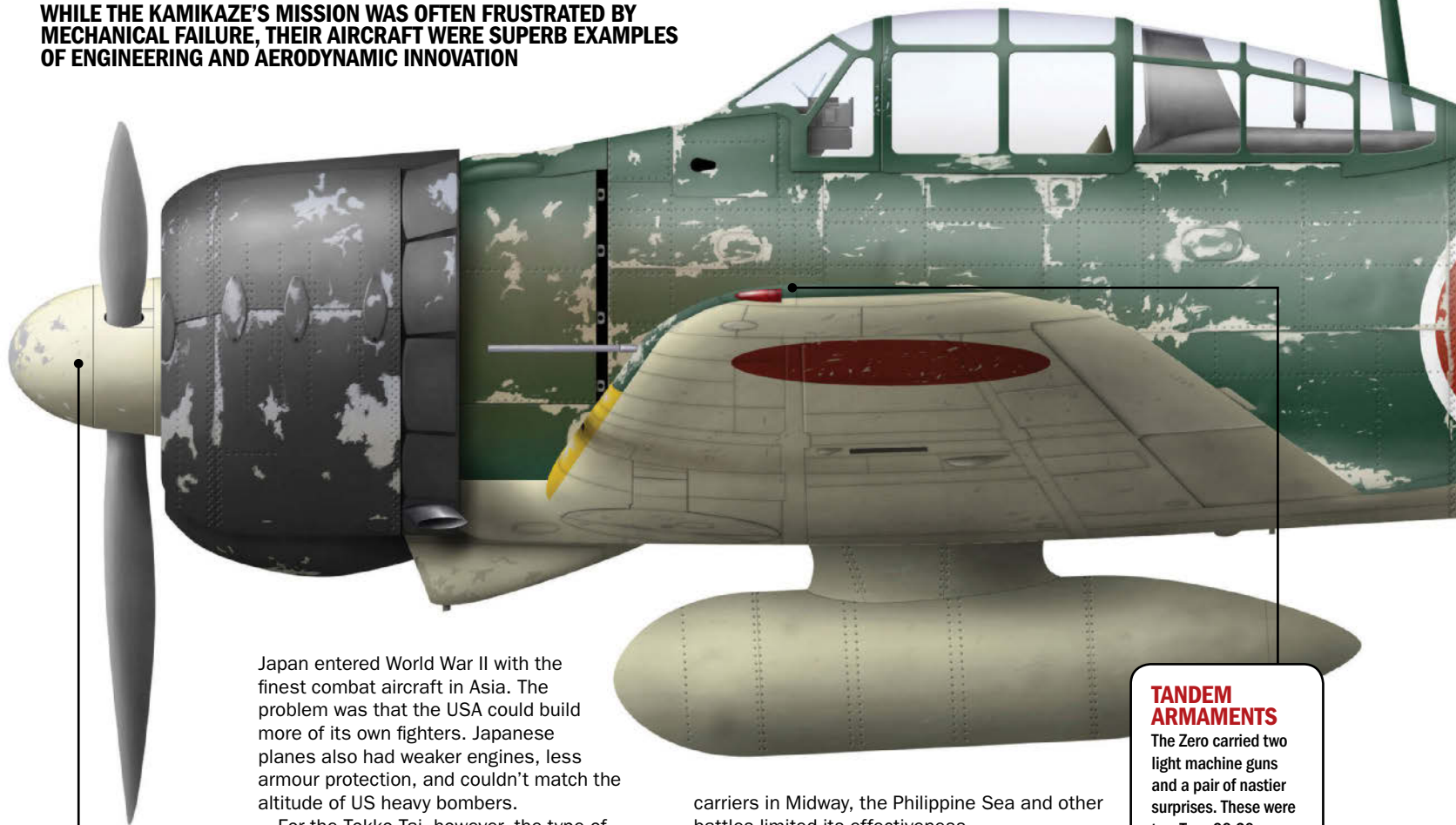
Takijiro Onishi was responsible for some of the technical details of the attack on Pearl Harbor

Before taking to the skies, Tokko Tai pilots donned a cotton hachimaki bandana as a symbol of their individual determination



MACHINE OF DEATH

WHILE THE KAMIKAZE'S MISSION WAS OFTEN FRUSTRATED BY MECHANICAL FAILURE, THEIR AIRCRAFT WERE SUPERB EXAMPLES OF ENGINEERING AND AERODYNAMIC INNOVATION



THE IMPERIAL CHAMPION

Entering production in 1940, the A6M Reisen or Zero became notorious in China for defeating any aircraft that flew against it. During the months after Pearl Harbor, it continued winning dogfights against many Allied planes it faced in the air.

Japan entered World War II with the finest combat aircraft in Asia. The problem was that the USA could build more of its own fighters. Japanese planes also had weaker engines, less armour protection, and couldn't match the altitude of US heavy bombers.

For the Tokko Tai, however, the type of aircraft wasn't always important. The plan, drawn up at Tachiarai Joint Service Flight School outside Chiran as well as in other nearby airfields, was to deploy as many Special Attack formations as possible.

In 1945, there was still enough A6M Zeros left for use in kamikaze missions. Hundreds of the older A5M fighters were co-opted for the missions as well. Designed by the inventor and engineer Jiro Horikoshi in the late 1930s, the Zero was a lightweight marvel with superb manoeuvrability and an excellent 14-cylinder 1,130 horsepower engine.

At the beginning of Japan's Pacific War, the Zero proved its superiority over American rivals like the F4F Wildcat. More than 10,000 Zeros would be built, but the gradual loss of IJN

carriers in Midway, the Philippine Sea and other battles limited its effectiveness.

The advent of Tokko Tai tactics marked the Zero's undoing. With insufficient armour plating, countless numbers of them were blown to bits as they approached US warships. The IJN Air Corps officers used aircraft like ordnance and cared little for keeping their planes airworthy. This, along with diluted aviation fuel supplies, explains the high rate of failure among Special Attack missions.

Once a Tokko Tai pilot was selected and trained, his plane was given enough fuel to reach the area of operations. A single 500-pound bomb was loaded along with ammunition for the twin 7.7mm machine guns and 20mm cannons. Barring a mid-air crash or an accident, the Tokko Tai pilot embraced his end as he flew to his target.

TANDEM ARMAMENTS

The Zero carried two light machine guns and a pair of nastier surprises. These were two Type 99 20mm cannons, one on each wing. Based on the Swiss Oerlikon, the Allied ships also used the same gun on incoming Zeros.

Below left: Zeros prepare for takeoff to take part in the first wave of the attack on Pearl Harbor

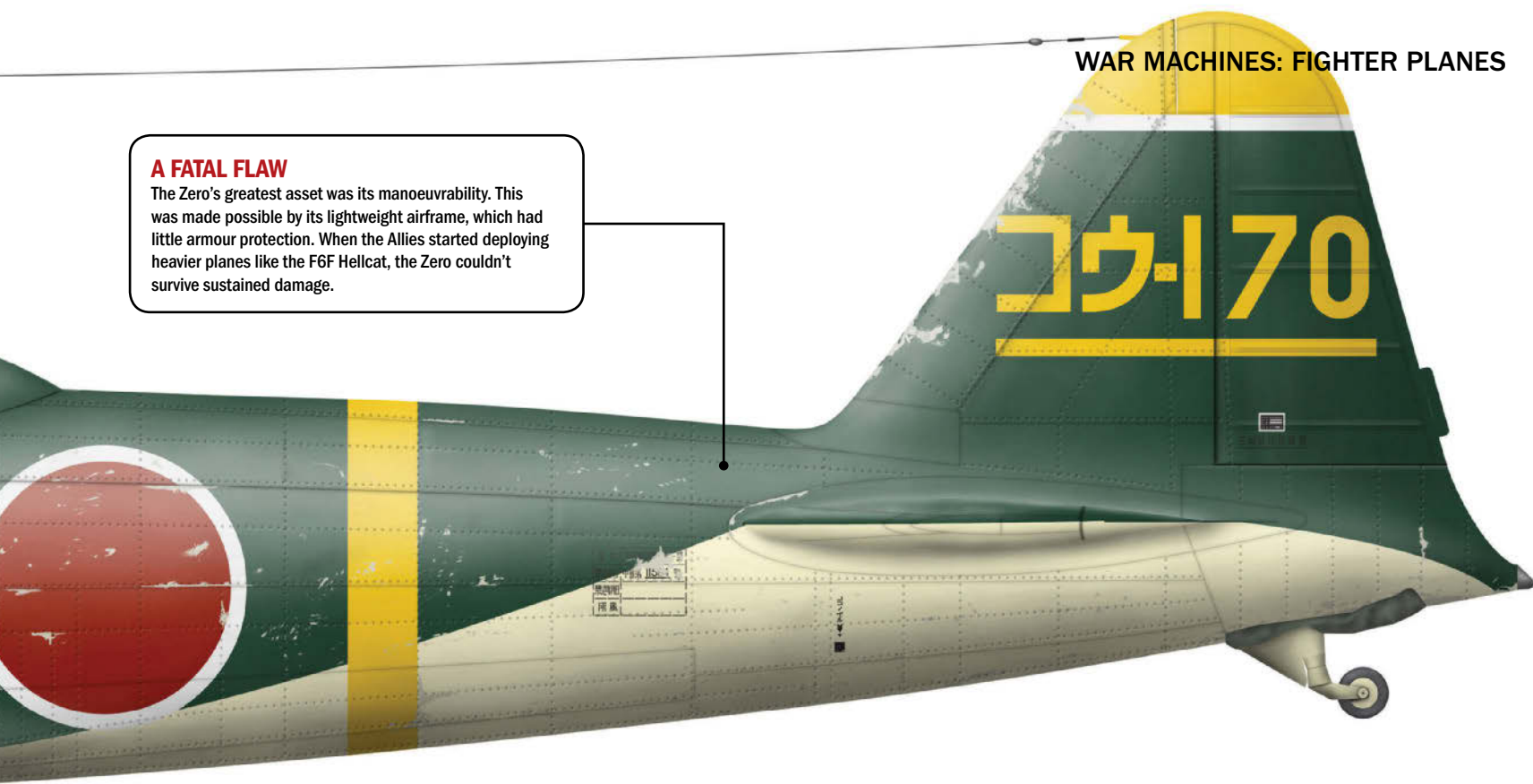
Below centre: The one-man cockpit of an A6M5 Zero Model 52

Below: A Mitsubishi A6M2b Zero from the Zuikaku Aircraft Group during the attack on Pearl Harbor



A FATAL FLAW

The Zero's greatest asset was its manoeuvrability. This was made possible by its lightweight airframe, which had little armour protection. When the Allies started deploying heavier planes like the F6F Hellcat, the Zero couldn't survive sustained damage.



A FINAL FLIGHT

MOST TOKKO TAI PILOTS WERE DETERMINED TO KILL THEMSELVES, BUT ON ONE OCCASION, FATE HAD OTHER PLANS FOR AN UNLUCKY FLIER

For thousands of American sailors and pilots, thwarting the incoming kamikaze was a living nightmare. Surviving the experience naturally inspired a curious regard for the Japanese who seemed so eager to vanquish them. Soon after the war's end, a story ran in *Yank*, the US Army's

weekly news magazine, about the experiences of a genuine kamikaze pilot. Contrasting the often one-dimensional and racist depiction of Japanese servicemen, the profile of Norio Okamoto tackles its subject matter with a little humour.

Okamoto fit the profile for a Tokko Tai candidate. A 23-year-old flight instructor wanting to avenge a brother killed on Formosa, he volunteered with grim enthusiasm. Okamoto then revealed a rare courtesy extended to Tokko Tai pilots. Before their deployment, they were allowed to write a short

letter home. He wrote to his parents for delivery after he died.

But he was soon disappointed by his treatment at the hands of the Tokko Tai officers. Not that he was abused or maligned, rather Okamoto was forced to endure lectures about the virtues of ancient samurai and sent off on "an old sea plane."

Okamoto crashed halfway to Okinawa due to engine failure and was stranded at sea with his navigator, who perished in the shark-infested waters. After hours afloat, he reached an island inhabited by suspicious natives deathly afraid of US air strikes. He was well fed and sat out the war until its end.

Interestingly, Okamoto didn't mind helping himself to boxes of American C-rations that floated ashore. He wasn't bitter towards his country's occupiers either. Okamoto aspired to become a trader of imported merchandise.

Numerous accounts of Tokko Tai pilots and their experiences have been published since 1945; just as many films and documentaries are released based on their memoirs. But not all recollections were as light-hearted as Norio Okamoto's.

For Warrant Officer Shoichi Ota, who carried out the doomed Ohka programme with its emphasis on a manned bomb, the stigma of being involved in Special Attack activities was too much to bear.

A rumour spread that he crashed a plane into the sea after Japan's surrender. It turned out that he changed his name during the Allied occupation of Japan and raised a family, putting his past behind him. He never spoke about his role during the war until he became unwell in his old age. Shortly before his death in 1995, he finally confessed to his son.

Grim proof of Onishi's handiwork. Once Tokko Tai missions began in October 1944, any large Allied ship was fair game



STATE SHINTO AND THE GOD EMPEROR

WHAT WERE THE UNDERLYING REASONS BEHIND JAPAN'S CULT OF SELF-SACRIFICE AND WHY DID SO MANY YOUNG MEN ACCEPT THEIR ROLE AS KAMIKAZES?

There are still many false assumptions surrounding the kamikaze of World War II. Most striking is the belief that it was embraced by the IJN as a credible strategy. For Tadanao Miki, an engineer tasked with building the Ohka flying bomb (dubbed the 'cherry blossom'), the idea was bizarre when first mentioned to him. What made its practice widespread, especially during the Okinawa campaign, was the profound sense of duty among Japanese servicemen and citizens. This is why personal appeals by the emperor together with rosy propaganda inspired so many volunteers. It was certainly ignoble death, but it was for a higher cause.

Japanese soldiers, being patriotic to the core, weren't obsessed with dying either. Death in battle was a last resort and many kamikazes who survived the war admitted a reluctance to squander their lives.

Although Japan's samurai heritage is often pointed out as an inspiration for suicidal actions in battle, it's quite ironic that the samurai ideal of 'bushido'

in its classical sense wasn't immediately intertwined with the conduct of kamikaze pilots. When the Yasukuni shrine was erected in Tokyo in 1869, the final year of the Meiji Restoration that replaced the Tokugawa Shogunate, Japan slowly shed its feudal system and its values. Instead, Yasukuni represented Japan's newfound modernity and the emperor's place in it.

After a Prussian-influenced constitution was adopted in 1898, a deference for state institutions began to mould the national character. This meant total obedience to the emperor, whose divine mandate imbued the government, the military, the university and civil society with an overwhelming importance above the needs of any individual.

This state of mind was reinforced by powerful symbolism, like the 16-petal chrysanthemum, the Imperial seal, and a call to obedience used as an emblem by the Japanese Army and Navy.

Japanese servicemen began sacrificing themselves as soon as the tide began to turn against their country. The critical moment was the arrival of American long-range bombers in 1944. Unable to defeat American B-29s with machine guns, remote incidents of fighter pilots ramming their planes began to warrant notice.

A growing awareness of Japan's vulnerability influenced the suicide ideal among the officer class. With the tacit endorsement by the Japanese high command, those responsible for the Ohka flying bomb programme and willing officers in the IJN Air Corps soon organised a genuine suicide force despite its low chances of success.

Below: Kamikaze pilots at the Imperial Japanese Chiran air base in Chiran, Kagoshima, toast cups of sake before departing on their Tokko Tai missions

A human deity who lived in secluded splendour, Emperor Hirohito is believed to have secretly approved of the Tokko Tai program



THE CHERRY BLOSSOM TAKES FLIGHT

LIKE A CRUDE EXOCET, A RESOURCE-POOR JAPAN MANAGED TO BUILD A VIABLE ANTI-SHIP MISSILE. BUT COULD IT TURN THE TIDE?

As early as 1943, the Aeronautical Research Laboratory was tasked with developing a rocket-powered 'flying bomb'. In or before August 1944, Warrant Officer Shoichi Ota told a befuddled Lieutenant Commander Tadanao Miki that in lieu of a guidance system, his team should just install a cockpit on the MXY7 Ohka, the primitive cruise missile they referred to as cherry blossom.

The suggestion launched the Divine Thunder God Corps, the IJN's newest elite unit and the original Tokko Tais. The Thunder Gods were supposed to steer their missile, which was packed with 2,600 pounds of explosive, to a target after being dropped in mid-air by a 'mother ship' – a bomber.

There was precious little time to organise, train and equip the Thunder Gods for their deployment. The first batch of Ohkas were supposed to be deployed in the Philippine Islands in 1944 but their transport, the aircraft carrier Shinano, was sunk by an American submarine.

The largest Thunder God mission involved a flight of 18 G4M medium bombers heading for Okinawa. The formation was intercepted by US



Air crew relax in front of a Mitsubishi bomber loaded with an MXY-7 Ohka plane

warplanes and destroyed. Later in the Okinawa campaign, a single Ohka reportedly managed to target the destroyer USS Mannert L Abele and sink it.

The concept behind the Ohka might have been futuristic, but these cherry blossoms

repeatedly failed their missions. When US forces seized production models of the Ohka on 1 April 1945, they re-christened it the Baka – Japanese for 'stupid'. Maybe because it was April Fool's Day, or perhaps the idea of a piloted bomb was too silly to comprehend.

“THE THUNDER GODS WERE SUPPOSED TO STEER THEIR MISSILE, WHICH WAS PACKED WITH 2,600 POUNDS OF EXPLOSIVE, TO A TARGET AFTER BEING DROPPED IN MID-AIR BY A ‘MOTHER SHIP’ – A BOMBER”



The original MXY-7 Ohka was supposed to have rocket boosters on its wing tips, but production models shed this feature

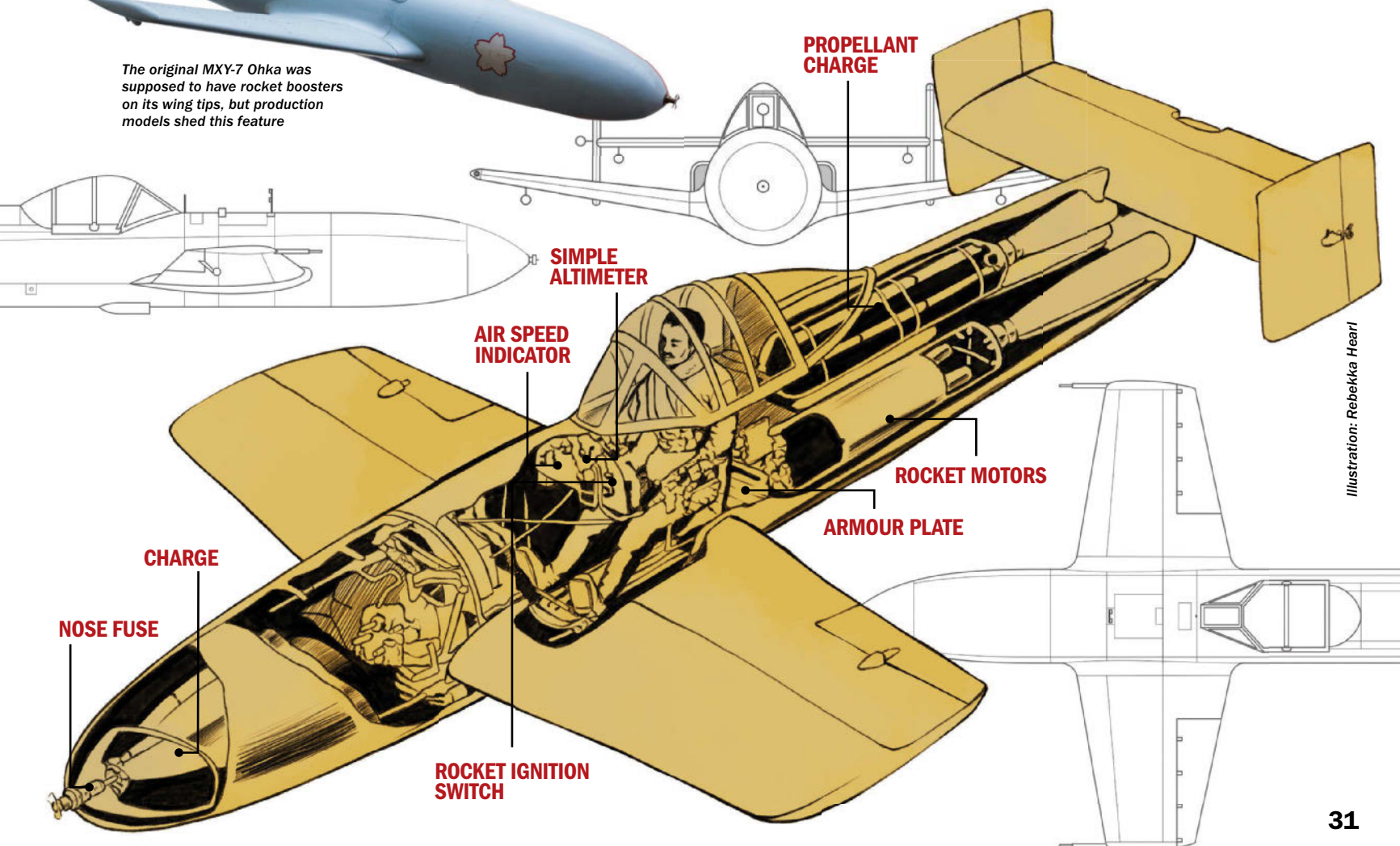


Illustration: Rebekka Hearl

CRACKING THE AIR LIKE THUNDER

FOR ALLIED WARSHIPS AND THEIR CREWS, THE LAST AND ONLY LINE OF DEFENCE FROM FANATICAL KAMIKAZES WAS GOOD OLD-FASHIONED FLACK

The Special Attack proved more ineffective the more it was used. Since the kamikazes were only used en masse in two campaigns – Leyte Gulf and Okinawa – a specific doctrine was never developed by the US Navy and Air Corps to counter them. Most kamikaze missions failed anyway, thanks to poorly maintained aircraft, shoddy training, and a far more lethal factor: US gunnery.

By 1945, US warships were equipped with incredible anti-air and anti-submarine weapons. The former included radar-assisted guns, AA gun batteries and rapid-fire cannons. Most effective were the twin 40mm Bofors mounted in nests on US Navy destroyers, carriers and transports. These ack-ack guns filled the air with flack at medium ranges.

If a lone kamikaze got too close, a 20mm Oerlikon or tandem .50-calibre machine guns

would blow it to pieces. Just as vital was US Navy air cover for blowing up any incoming suicide planes.

By the time Okinawa was firmly under American control, it proved to be the costliest battle in the Pacific Theatre. A total of 2,363 kamikaze attacks between October 1944 and 21 June 1945 left more than 5,000 US and Allied dead.

Approximately 40 Allied ships of all types were sunk. An additional 368 were damaged. A little more than a month after Okinawa, atomic bombs levelled Hiroshima and Nagasaki. Japan surrendered on 15 August. The last kamikaze squadrons were disbanded and the once-doomed pilots lived on to demobilise for peacetime. 70 years since, the kamikazes' notoriety remains a potent symbol of Japanese fighting spirit during World War II.

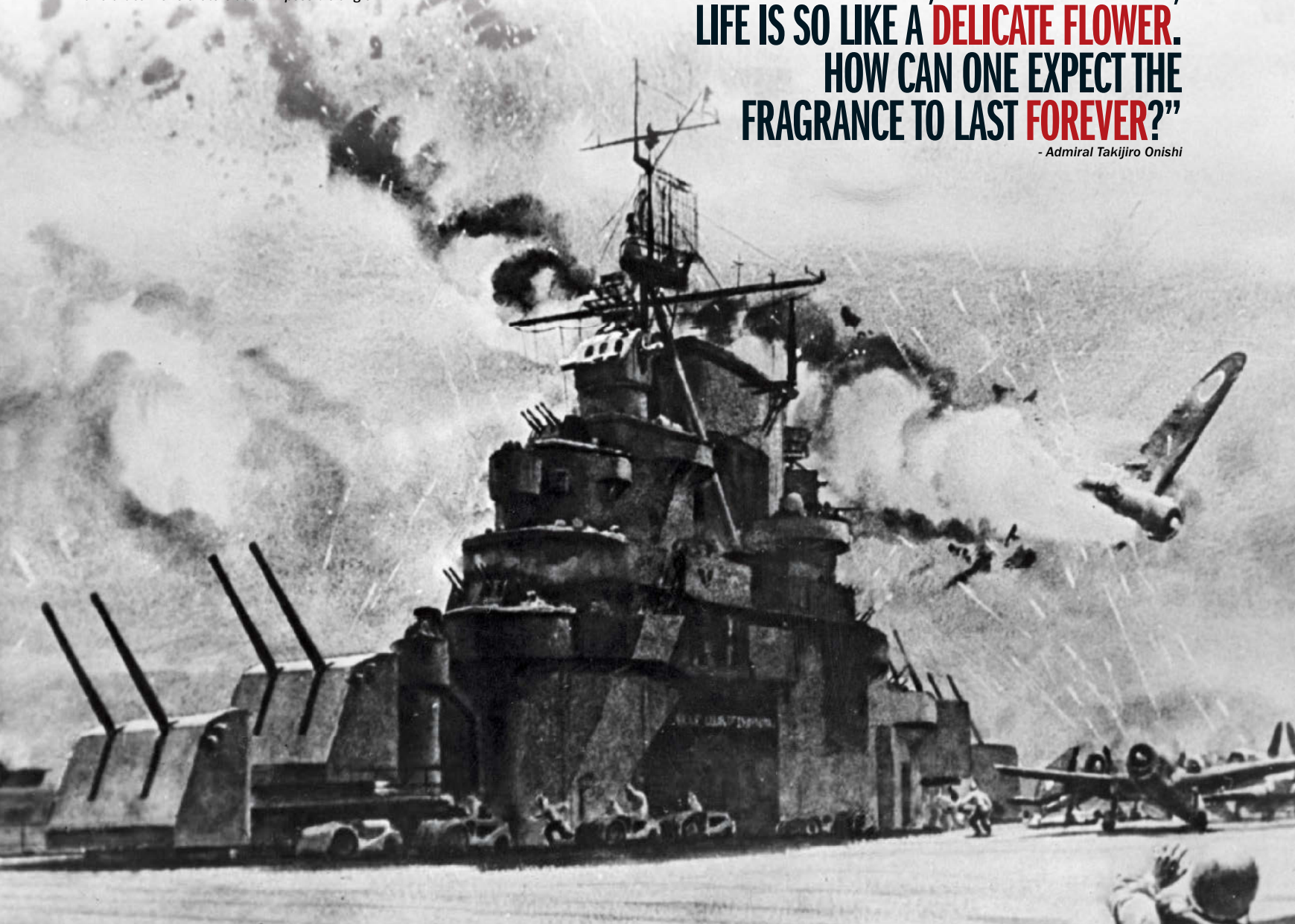


The US Navy's four-barrel 1.1-inch or 28mm cannon was a crude close-in weapons system that spewed hot lead at 600 rpm

This image, moments before a kamikaze's impact, shows how Japanese pilots targeted aircraft carrier elevators at an impossible angle

**"IN BLOSSOM TODAY, THEN SCATTERED;
LIFE IS SO LIKE A DELICATE FLOWER.
HOW CAN ONE EXPECT THE
FRAGRANCE TO LAST FOREVER?"**

- Admiral Takijiro Onishi



The 40mm Bofors of Sweden was a European success before licensed production began in the United States in June 1941



GRUMMAN F4F

A hardy fighter that helped the Allies dominate the war in the Atlantic and the Pacific

WORDS JACK GRIFFITHS

The Fleet Air Arm Museum's Martlet is the only surviving F4F-4 model in the world and was the fighter the Allied navies desperately needed in 1940

**"IT GAINED A REPUTATION
AS A TOUGH AND RELIABLE
FIGHTER PLANE THAT COULD
SOAK UP AXIS BULLETS"**

MARTLET



7,885 F4Fs were built in total and they were the main shipboard fighters for the USA when it entered the war in 1941

GRUMMAN MARTLET AL246

LENGTH: 8.8M (28.9FT)
 WINGSPAN: 11M (38FT)
 RANGE: 1,239KM (770 MILES)
 ENGINE: RECIPROCATING WRIGHT
 R-1820 G205A CYCLONE
 MAXIMUM SPEED: 527KM/H (328MPH)
 CEILING: 12,029M (39,500FT)
 CREW: 1
 PRIMARY WEAPON: 4 X 0.51N M2
 BROWNING MACHINE GUNS
 SECONDARY WEAPONS: 2 X 100LB BOMBS

Originally ordered by France from the USA in 1940, the Grumman Martlet was produced too late to aid the French when the Wehrmacht marched into the Ardennes. Sent back to Britain instead, the aircraft would play a key role in all theatres of World War II from Norway to Africa and the Far East.

1,123 Martlets served the Allies in the war and the craft became invaluable in the Battle of the Atlantic, sinking 23 U-boats. Their main role was to provide anti-submarine support for the Arctic convoys that sent supplies to and from the Allied powers. However, they are most famous for proving their worth in the Pacific with the American forces.

Known as the Wildcat in the USA, the fighter contributed to the battles of Wake Island and Midway, among others. There, it gained a reputation as a tough and reliable fighter plane that could soak up Axis bullets. It may not have been as technically advanced as its rival, the Japanese Mitsubishi Zero, but its higher-service ceiling allowed it to power-dive the Zero out of the sky.

Production of the aircraft ceased in 1945 as newer planes such as the iconic F4U Corsair and F6F Hellcat replaced the by-now aging Wildcat. The final victory-to-loss ratio for the F4F during the war was an astonishing 69:1, demonstrating just how valuable it was to the Allies.

WILDCAT FIGHTER ACES THE HIGHEST-SCORING US F4F PILOTS OF THE WAR



MAJOR JOE FOSS

Joe Foss was the top-scoring ace of the war with 26 victories in just 44 days of combat.

He was awarded a Medal of Honor for his services and served with distinction as a lead pilot in the Guadalcanal Campaign.



COLONEL JOHN LUCIAN SMITH

The destroyer of 19 Japanese planes, John

Lucian Smith was another recipient of the Medal of Honor. In the Solomon Islands Campaign, he led Marine fighter Squadron 223, which downed 83 aircraft.



MAJOR GENERAL MARION EUGENE CARL

Marion Eugene Carl was awarded the Navy Cross

twice, his first earned at the Battle of Midway and his second won at Guadalcanal. At one point his fighter was shot down and he spent five days living with natives.



The dials in the cockpit are all original components and have not been altered since the aircraft arrived at the museum



Moving on from the age of the open cockpit, the Martlets incorporated a plate of armoured glass in front of the pilot

COCKPIT

Seated right in the centre of the fuselage, behind the engine, the pilot had a good view of his surroundings, which helped with manoeuvres and overall performance in dogfights. The only downside was a reduced viewpoint of the pilot's 'six' due to the razorback design of the cockpit. The landing gear was controlled by a hand crank, which was one of the oldest contraptions on the whole aircraft. F4Fs often lacked armour behind the seats when they came straight off the production line, but this was strengthened before they were thrust into battle.

WHEELS

The narrow track undercarriage gave the aircraft its name, Martlet. In English tradition, a Martlet is a bird with ineffective legs, and the fighter was renowned for having a weak undercarriage, so the name stuck. The Martlet name was not taken on by US forces, which preferred the more war-like title Wildcat. One of the most advanced devices on board the plane was the ZB homing device, which allowed the aircraft to find ships within a 48-kilometre (30-mile) range when troubled by poor visibility.



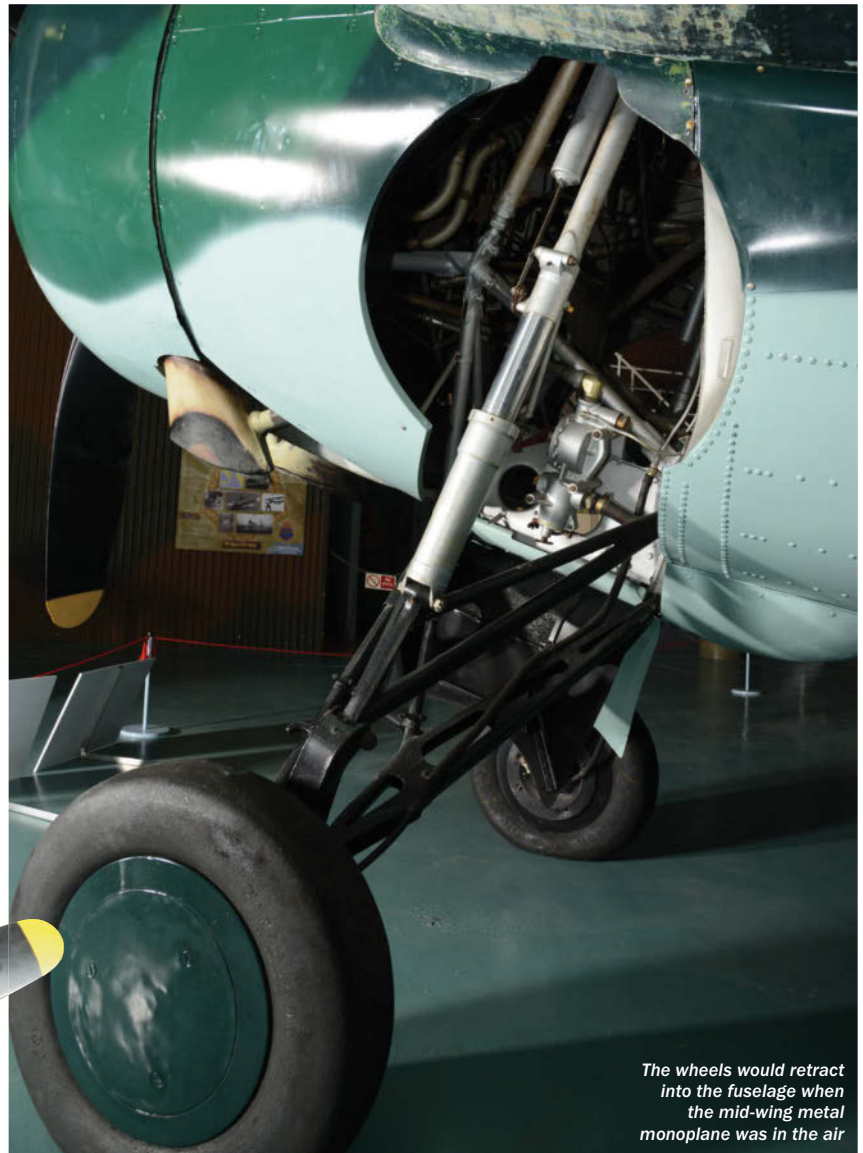
The F4F was a barrel-shaped plane with angular wingtips and narrow undercarriage. Auxiliary fuel tanks greatly increased its range

“THE MARTLET NAME WAS NOT TAKEN ON BY US FORCES, WHICH PREFERRED THE MORE WAR-LIKE TITLE WILDCAT”



WRIGHT R-1820 G205A CYCLONE ENGINE

With a constant-speed three-bladed propeller, the pace of the F4F allowed it to strafe targets before the heavy bombers were called in to finish the job. The F4F's power came from its nine-cylinder engine that packed more than 1,000 horsepower into the fighter. This particular model used the Wright R-1820 Cyclone while later models, especially in the USA, installed a redesigned Pratt & Whitney R-1830-76 series engine that included a two-stage supercharger. The engine was situated in front of the pilot but was cleverly fixed in a way that did not obscure his forward view.



The wheels would retract into the fuselage when the mid-wing metal monoplane was in the air

RIVALS IN THE SKY WHICH AIRCRAFT TUSSED WITH THE F4F FOR AIR SUPREMACY?

MITSUBISHI A6M ZERO

The scourge of the F4F in the Pacific theatre of World War II, the Zero could outmanoeuvre the Wildcat and had a much longer range. It held this advantage over the F4F until the US pilots began using hit-and-run attacks that allowed their fighters to weave and protect one another's tails, tactically outthinking the Japanese.



MESSERSCHMITT ME 109 T

The Third Reich preferred to use U-boats instead of carriers, so carrier-based fighters never got off the ground for the Kriegsmarine. The Me 109 T was a version of the Messerschmitt considered for Nazi carriers but only 70 were made before the programme was cancelled. This small number was still used in the defence of the Reich.



BREWSTER F2A BUFFALO

Before the F4F made its name in the war, the Buffalo was actually the preferred aircraft of the USA. The successor to the F3F biplane, it soon became apparent that the Buffalo was too sluggish and cumbersome to be effective in the air. They struggled in the Battle of Midway and were soon replaced by the Wildcat throughout the US Navy.



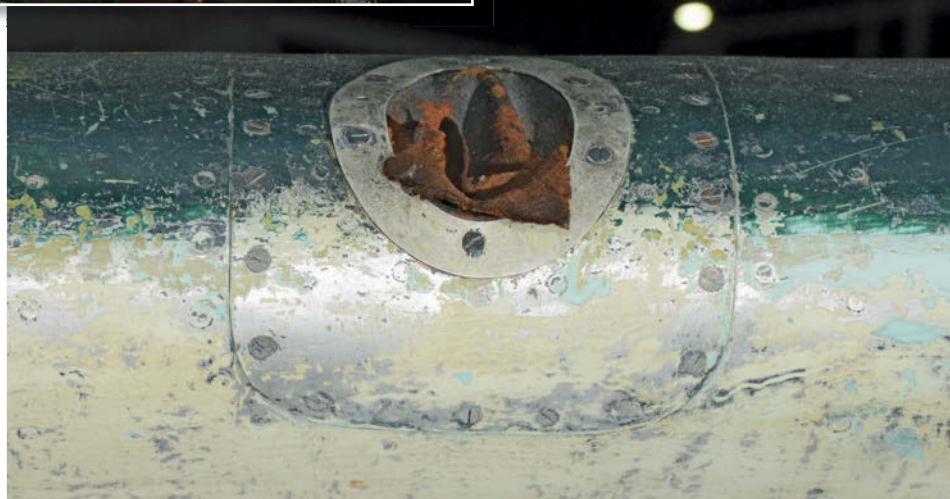
Our Senior Staff Writer Jack went to see the Martlet at the Fleet Air Arm Museum, which is one of the UK's four Royal Navy museums



One of the main features of the Martlet F4F-4 was folding wings, allowing more to be stored on carriers

MACHINE GUNS

To blast enemies out of the sky, the F4F had four .50 calibre Browning machine guns carrying 400 rounds each. Later models of the Wildcat had six machine guns, which not only added more power but was also a relief to the pilots, as the armament had an unfortunate habit of jamming. When engaging U-boats in the Atlantic, the fighter would shield bombers such as the Avenger from the submarine's anti-aircraft fire while the bomber dropped depth charges and acoustic torpedoes. The Wildcat had a limited bombing capacity of its own and carried just two 100lb bombs.



Some US pilots, like Edward 'Butch' H O'Hare, were so accurate with the F4F weaponry that they could aim and shoot directly at the engines of enemy fighters

**“THE WILDCAT HAD A
LIMITED BOMBING CAPACITY
OF ITS OWN AND CARRIED
JUST TWO 100LB BOMBS”**

*Five U.S. Navy Douglas SBD Dauntless dive bombers
and four Gruman F4F-4 Wildcat fighters on the flight
deck of a Sangamon-class escort carrier during
Operation Torch in November 1942*



★ ★ ★ ★ THE UNSUNG HEROES OF THE BATTLE OF BRITAIN ★ ★ ★ ★

303 SQUADRON

WORDS DAVID SMITH

Among the deadliest but least celebrated pilots to fight the Luftwaffe during Britain's time of need were Poland's fighter aces. This is the story of their finest hour

August 1940: for three weeks, the men of 303 Squadron have been forced to wait while the German war machine readies itself to smash the last resistance in Western Europe. Not that they have been idle – pilots and ground crew have been training hard to operate their Hurricane Mk Is, and they are nearly ready to renew a fight that, for

them, began in their homeland of Poland and continued in France.

Everywhere the Poles have been, the Germans have proved inescapable, forcing them to find a new base from which to continue their struggle. The Battle of Britain may have been raging for weeks, but the men of 303 Squadron have already been fighting for a year.



**"THE BATTLE OF BRITAIN MAY HAVE BEEN RAGING
FOR WEEKS, BUT THE MEN OF 303 SQUADRON
HAVE ALREADY BEEN FIGHTING FOR A YEAR"**



Rising from Poland's ashes

The Polish Air Force (PAF) was reorganised just prior to the outbreak of hostilities in September 1939, with the bulk of the eskadras (escadrilles or flights, which were grouped together into squadrons) being allocated to Polish land forces. The exception was the Brygada Poscigowa, the 'Pursuit Brigade', which was tasked with defending Warsaw.

Despite the technological inferiority of its machines, the PAF downed more than 100 German planes and Pilot Officer Stanisław Skalski of 142 Eskadra became the first Allied 'ace' of the war, downing four German planes and sharing in the destruction of a fifth.

As the Polish armed forces fell back before the German advance, they could count on the forests and marshland in eastern Poland to slow their enemy down on the ground, while new planes (including Hurricanes) were expected to arrive via neutral Romania at any moment to match the Germans in the air. Such hope was dashed on 17 September, when the Soviet Union invaded Poland from the east. The next day, the remaining PAF forces were ordered to make their way as best they could to Romania or Hungary. It was to be just the first step of a long journey. From their temporary havens, the Polish pilots headed for France, mostly by ship (the few P.11s that had been flown to Romania were left there), and quickly started preparations for the next stage of their war.

Some Polish forces, perhaps recognising the likelihood of German success in France, headed immediately for Britain. However, most, pilots and air crew alike, started frantic retraining on the Morane-Saulnier MS.406 – a plane with a passing resemblance to the Hurricanes the men of 303 Squadron would fly with such distinction during the Battle of Britain.

A total of 130 Polish pilots took part in the Battle of France, with many serving in the

'Montpelier Squadron' (so called because that was where they had undertaken their conversion courses for the MS.406), which was divided between several French formations.

The willingness of the Polish to fight wherever and whenever was exemplified by a squadron that trained in France in order to fight against the Russians in Finland. Before they could be transferred, however, the Finns made their separate peace with the Soviet Union on 12 March 1940. Even after being asked to fly the inferior Caudron-Renault C.714 Cyclone, a seriously underpowered plane with a wooden frame, the Polish pilots stubbornly persevered. French authorities declared the plane unfit for combat after early negative feedback, but with no alternatives available, the pilots flew on.

Of course, the end of this chapter came quickly. Having been credited with the destruction of 60 German planes (at a cost of 13 pilots killed), the Polish airmen were on the move once more after France surrendered. Scattering in any planes they could get their hands on, or making their way to French ports, the men headed for Marseilles, La Rochelle, North Africa and Gibraltar. Their routes may have been varied, but their destination was always the same – as far as they were concerned, there was simply nowhere else to go.

The island of last hope

The Polish airmen had put up a brave fight in their homeland and in France, and they could have headed for the USA or Canada with pride intact. But only one nation still offered the prospect of continued combat operations against the Germans.

Despite this, Britain was a very different experience for the Poles. Where they had enjoyed their own 'special relationship' with the French, which meant that most of them spoke excellent French, they had little or no



Below: Members of 303 Squadron after returning from a sortie in October 1940

Top: This Polish propaganda poster told the country its air force was 'strong, serried, ready'
Right: A 1939 British tabloid reports on the Polish Air Force bombing Berlin



"SOME POLISH FORCES, PERHAPS RECOGNISING THE LIKELIHOOD OF GERMAN SUCCESS IN FRANCE, HEADED IMMEDIATELY FOR BRITAIN"

English. The French method of spreading Polish pilots through existing squadrons would be problematic in the RAF, but that was how the first men to arrive made their contributions.

Some of those who had moved on to Britain soon after reaching France were already in training. Fighter aces were even prepared to take up posts in bomber squadrons, so keen were they to keep fighting. This enthusiasm led to one of the many myths about the Polish Air Force – that their personnel were brave but reckless, and that they paid a heavy price for it.

The Polish fighters were indeed brave, and their preferred tactic – closing to extremely close range before opening fire on an enemy – appeared to the British to be quixotic.

It would take some time for this misapprehension to be remedied and for the Polish airmen to be recognised for what they were – some of the best pilots available to the RAF. Their experience was valued from the start, but it was with British units that they made their first contributions.

Of course, their support was badly needed. Britain, anticipating a major air confrontation with Germany, had been investing heavily in its air force since 1937, but when war came, it did not follow the expected pattern. German military planning was not based on massive strikes from the air, but on tight co-operation between air and land forces. The nightmare of bombing raids against cities was not part of the plan – it was only to be considered in retaliation for similar raids. Britain's army was small at the outbreak of war and was unable to make a difference on the continent.

The RAF, which had envisioned flying over home ground with the benefit of radar, was much less effective when shorn of these two major advantages. No fewer than 477 fighters and 284 pilots were lost in France. Fighter Command's Sir Hugh Dowding begged the War Cabinet to stop sending his precious planes over the Channel. Spitfires were not committed until the evacuation at Dunkirk, but even so the British lost 155 of their premier aircraft.

However, the war was about to enter a phase that the British had been planning for – a defensive struggle to prevent an invasion. On 18 June, Winston Churchill christened the battle to come when he declared: "The Battle of France is over. I expect the Battle of Britain is about to begin."

Polish fliers were airborne with RAF squadrons as early as July 1940, with the first kill credited to Flying Officer Antoni Ostowicz on 19 July, when in action with 145 Squadron. In one of war's many cruel ironies, Ostowicz was also the first Polish pilot to be killed in the Battle of Britain. Nearly 100 Polish pilots flew with 27 fighter squadrons, moving from one unit to another as needed. They would undoubtedly have been willing to continue in this manner, but it was quickly realised that they could be more effective in dedicated Polish squadrons, where the language barrier and the differences in operational doctrine would not be problems.

THE PURSUIT BRIGADE

HOW THE POLISH AIR FORCE TOOK THE FIRST FIGHT TO THE LUFTWAFFE IN 1939

One of the myths of the war, propagated by the Nazis, was that the Polish Air Force had been destroyed on the ground in the first two days of the German invasion. In fact, the Poles had known what was coming and had moved their fighters to new bases before the Nazis struck. The problem was that those fighters were badly outperformed by their German counterparts and even struggled to compete with bombers.

The Pursuit Brigade (Brygada Poscigowa) was comprised of two squadrons responsible for defending Warsaw. Three units, 113, 114 and 123 Eskadras, made up IV/1 Dywizjon (Squadron), based about 11 kilometres north of Warsaw.

Operating from a base about five kilometres north east of Warsaw, III/1 Dywizjon comprised 111 and 112 Eskadras. The famed 303 Squadron would largely be made up of pilots from this unit. Most of the pilots in the Pursuit Brigade flew PZL P.11 fighter aircraft, although 123 Eskadra had to make do with P.7s. Less than a decade old when the war opened, the P.11 had nevertheless been rendered nearly obsolete by modern developments in fighter technology. It had a distinctly old-world look, with its open cockpit and fixed undercarriage.

Unable to catch German planes from behind (its top speed was just 242 miles per hour), P.11 pilots were forced to tackle them head-on, and the relative weakness of the P.11 armament (two or four 7.92mm machine guns) meant that they had to close to the sort of ranges that would have made an RAF pilot blanche to have a chance of downing an enemy.

Seriously outnumbered as well, it is no surprise that the PAF lost about 85 per cent of its aircraft during Poland's brief war, but it also claimed more than 100 kills, and the experience gained by the pilots was to prove invaluable in France and Britain.

"THE P.11 HAD BEEN RENDERED NEARLY OBSOLETE BY MODERN DEVELOPMENTS IN FIGHTER TECHNOLOGY"



A Stuka dive-bomber claimed the first kill of the war in Poland, downing a P.11 as it was taking off



Above: The PZL P.11c may have been slow and lightly armed, but it was a tough plane with an all-metal construction



SCRAMBLE!

WHEN THE CALL CAME, PILOTS WERE RELYING ON THEIR GROUND CREWS

During the daily intensity of the ongoing struggle with the Luftwaffe, the RAF's ground crews were just as important as the pilots in the air. It was their job to ensure the planes were refuelled, repaired and re-loaded for take-off when the order to 'scramble' was given. Ground crews were also tasked with clearing runways of any debris from crash-landings. Pilots trying to steer damaged aircraft back to base as best they could often left a wake of carnage behind them.

A group of pilots rush to their planes as the order to take off is sounded



Giving the Poles their own squadrons would also enable them to keep alive the unit histories that meant so much to soldiers, sailors and airmen. It meant that 303 Squadron, the fourth Polish squadron to be formed, was able to resurrect the 'City of Warsaw' name that it had carried when part of the Pursuit Brigade. The squadron's roots, however, ran even deeper than this.

Rise of the Kosciuszko squadron

Following World War I, Poland emerged from more than 100 years of partition to be an independent nation once more. The Polish-Bolshevik War, however, threatened to end this almost immediately, with Lenin intent on absorbing the country within the Soviet Union. Help for Poland came from many quarters, but perhaps the most remarkable was the squadron of American volunteer pilots formed by Merian Cooper. Taking their place in the Polish Air Service as the 7th Squadron, they were nicknamed the 'Kosciuszko Squadron', after a Polish general that had served with the Americans during their own War of Independence. The squadron's badge, designed by American pilot Elliott Chess, combined American and Polish elements such as red and white stripes and 13 blue stars (representing the original 13 American states) into an eye-catching emblem.

Following the distinguished service of the American pilots (three of whom died during the war), the Kosciuszko name was taken on by 111 Eskadra, part of the Pursuit Brigade, which in turn provided the basis for 303 Squadron.

"IT WOULD TAKE SOME TIME FOR THIS MISAPPREHENSION TO BE REMEDIED AND FOR THE POLISH AIRMEN TO BE RECOGNISED FOR WHAT THEY WERE – SOME OF THE BEST PILOTS AVAILABLE TO THE RAF"

It was an illustrious history, based on the willingness of foreign pilots to fly in another nation's air force. It is difficult to imagine a more fitting background for the men who started training in Britain in August 1940.

The men of 303 Squadron were immortalised in a book by Arkady Fiedler. While many unit histories are written long after the events, with aging veterans recalling their days of service, *303 Squadron* is a very different text. Written during the Battle of Britain, it has an immediacy that instantly grips the reader. Fiedler was an emotive and emotional writer, but even the occasionally overblown rhetoric cannot alter the fact that he offered a glimpse inside the workings of a fighter squadron under the highest possible stress, and inside the workings of the fighter pilot's mind as well.

"The more-sensitive fighter pilots," Fiedler wrote, "clearly feel that their nerve ends reach

to the tips of their aircraft's wings. They feel them physically and emotionally. If an enemy damages one of their wings, they feel the shock as if they had been wounded themselves."

Fiedler also debunked another of the myths surrounding the Polish airmen – that they were consumed with rage when in the air. The young Polish pilots were, of course, hugely motivated by experiences in their home country, but in the air they were calm; their minds blank as instinct took over and they experienced "a sort of mental blackout." Only in this state could they hope to react quickly enough to survive.

The men of 303 Squadron did not have to wait for their training to officially end before taking the fight to the Germans. On 31 August, the last day of their conversion course to fly Hurricanes, they were 'vectored' onto a formation of German planes. Bombers and their fighter escort were returning after a raid when 303 Squadron found them. Five kills were made quickly, while a sixth was added by Lieutenant Zdzisław Henneberg after he had patiently followed a group of four retreating planes. Six kills, all Messerschmitt Bf 109s, had announced the arrival of the squadron in no uncertain terms, and their admission to the official strength of the RAF was timely – German strategy had shifted to target Fighter Command specifically.

The Luftwaffe attacks

Just as the shift to an air-based strategy suited the British, it caused problems for the Germans, who were used to combining their air and ground forces – independent



Hawker Hurricanes
fly in formation

Feric (far left) with other members of 303 Squadron at RAF Northolt



“FOLLOWING THE BATTLE OF BRITAIN, FERIC FOUGHT ON IN SPITFIRES, DESTROYING ONE MORE BF 109”

THE ULTIMATE SACRIFICE

MIROSLAW FERIC SURVIVED INVASION, EVACUATION AND THE BATTLE OF BRITAIN BEFORE FINALLY LAYING DOWN HIS LIFE IN AN RAF UNIFORM

Born in 1915 near Sarajevo, Feric moved to Poland in 1919 and fought as part of the Pursuit Brigade during the German invasion of 1939. He shared in two kills, but also only narrowly escaped death when forced to take to his parachute after another sortie. He fled to Romania on 17 September, and then on to France, where he fought under Zdzisław Krasnodebski, who was also to become his commanding officer in 303 Squadron.

As well as destroying six German planes during the Battle of Britain (four Bf 109s, a Bf 110 and an He 111) he also somehow found time to set up a squadron diary, the *303 Squadron Chronicle*, which has proved invaluable for students of the unit.

Following the Battle of Britain, Feric fought on in Spitfires, destroying one more Bf 109 and damaging another, before he was killed in an accident on 14 February 1942.

Awarded the Silver Cross of the Virtuti Militari, as well as the Cross of Valour (with two bars) and the British DFC, Feric is buried in Northwood Cemetery in Middlesex. His name lives on as both a street name and a primary school name in Poland.

air operations presented a new challenge. Famously, the British benefited from radar technology, but a far more prosaic system of ground-based observers was also available to Fighter Command and denied (obviously) to the Germans.

German tactics initially involved flights of Bf 110s (twin-engine heavy fighters), which were supposed to lure in British fighter units and leave the way clear for the bombers and their single-seater fighter escorts. However, the 110s suffered so badly they required their own escorts, nullifying their effectiveness. The ultimate symbol of the German way of warfare, the Stuka dive-bomber, also proved unsuitable for a role in the Battle of Britain. German bombers, meanwhile, especially the Junkers Ju 88, were good planes, but their payloads were small (the Ju 88 could carry 4,000 pounds of bombs, while the Lancaster would haul up to five times as much on its missions).

German high command appeared unsure over what strategy to pursue, targeting coastal defences, shipping and cities as well as fighter bases, but the overall aim was consistent, at least as far as the Luftwaffe itself was concerned – it was aiming to knock out Fighter Command. German bombers were initially expected to manage with only small escorts, as the fighters engaged their RAF counterparts. The RAF, however, prioritised attacks on the bomber formations, forcing the Germans to unite bomber with fighter into the sort of mixed formations that have become symbolic of the battle. The formations presented a big target to the pilots of 303 Squadron when they burst onto the scene on 31 August, and they lost no time in taking advantage.

The Regia aeronautica, the Italian air force, also took part in the Battle of Britain



Wonderful madmen

The successes of 303 Squadron during the Battle of Britain were so remarkable that some began to question the accuracy of their figures. Was it really possible for a group of reckless Poles to be outperforming every other RAF squadron? The group captain at RAF Northolt, Stanley Vincent, wanted to be sure and accompanied the squadron on a sortie flown on 5 September. He could hardly have chosen a better day. The nine Hurricanes that 303 Squadron could put in the air that day accounted for eight German planes to the loss of just one – and all their pilots returned safely. Vincent was amazed and delighted, calling his Poles ‘wonderful madmen’.

The dash and courage of the Polish squadron could not be denied, but following one of its greatest days, it then suffered through one of its most costly on 6 September. One pilot was killed, five Hurricanes destroyed and Major Zdzisław Krasnodebski suffered severe facial burns after his plane was hit. Despite the terrible losses, the day was a triumph for the squadron – a defensive action that saw its nine Hurricanes occupy huge numbers of German fighters and help to break up a major assault.

By stripping a massive bomber formation of its cover, 303 Squadron had allowed other units to get at the bombers themselves. Being a fighter pilot wasn't always about attacking, as Fiedler realised: “A fighter pilot's skill is displayed not only in the offensive, but also in the defensive role,” he wrote. “Above all, in the defensive role. While every soldier is easily able to take cover from enemy fire, a fighter pilot at an altitude of 20,000 feet has nothing but empty sky around him. Only lightning



The mascot of 303 Squadron, Misia, sits atop the 178th German aircraft destroyed by the unit

“SOMETIMES THE MEN OF 303 SQUADRON ATTACKED, SOMETIMES THEY DEFENDED – ALWAYS THEY WERE PUSHED TO THE LIMIT”

manoeuvres and exceptional, superhuman presence of mind can save him.’

The Battle of Britain played out in this fashion. Sometimes the men of 303 Squadron attacked, sometimes they defended – always they were pushed to the limit. The unsung heroes of the squadron, the ground crews (memorably described by Fiedler as the “colourless roots of brilliant flowers”) allowed the pilots to be sure of at least one thing as they ran to their Hurricanes: the planes would

not let them down. Despite the almost constant action, the ground crews of 303 Squadron failed to put 12 planes into the air on just four occasions. It wasn't always the same 12 planes. It wasn't always the same 12 pilots. The battle took a terrible toll on both groups, but the squadron was handing out more punishment than it was taking.

12 Dorniers were shot down on 7 September for the loss of two Hurricanes, with other British squadrons accounting for 61 planes and anti-aircraft fire destroying another 28.

Then came a dizzying 15 minutes on 11 September – a quarter of an hour in which the squadron scored 17 kills when engaging an airborne armada of 60 bombers, 40 Bf 110s and 50 Bf 109s. The first section of 303 Squadron, three planes, bypassed the fighters and headed straight for the bomber formation. The second section held the German fighters at bay, allowing the third to also target the bombers. Finally, the fourth section joined in the holding action against the fighters.

It was arguably the squadron's finest hour, but it came at a cost. Ground crews at Biggin Hill watched in appalled fascination as Sergeant Stefan Wójtowicz fought alone against nine Bf 109s, shooting two down before inevitability caught up with him. Also dying that day was Arsen Cebrynski, killed by machine-gun fire from a German bomber. RAF losses on the day totalled 24 planes and 17 pilots as well as the two fatalities in 303 Squadron.

By 15 September, the day that is now commemorated as Battle of Britain Day, the toll on 303 Squadron had become almost too much to bear. Three sorties were flown, but the grinding reality of the near- ceaseless combat was made clear by the number of planes that took part in each: 12 Hurricanes took to the air in the first sortie, nine in the second and just four in the third. Despite this, the Polish ground crews had 12 Hurricanes ready for action by dawn the following day. The ‘wonderful madmen’ had a supporting cast every bit as important as they were.

HURRICANE MK I

LIVING IN THE SHADOW OF THE MORE ILLUSTRIOUS SPITFIRE, THE HURRICANE WAS ARGUABLY THE BACKBONE OF THE RAF DURING THE BATTLE OF BRITAIN

The Hurricane comprised 55 per cent of Fighter Command's single-seat fighter force during the Battle of Britain. It was not as fast as the Spitfire (325 miles per hour compared to over 350 miles per hour), but it made up for this by being a more robust machine. From mid-August, Hurricanes were encouraged to concentrate on attacking bomber formations, with Spitfires handling the fighter escorts.

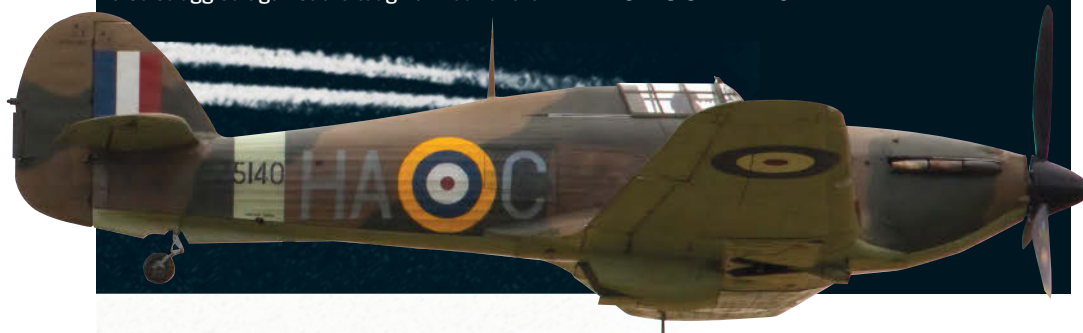
It's Achilles' heel, one that cost 303 Squadron's Zdzisław Krasnodebski dearly, was the lack of a self-sealing fuel tank. This defect was gradually rectified as the Battle of Britain progressed, but unmodified Hurricanes were prone to erupting in flames if hit in the fuselage-based tank.

The Hurricane's eight .303 machine guns also struggled against the tough armour of the

German fighters, and a mixture of incendiary and armour-piercing shells was used as well in an effort to compensate.

Propeller modifications were also introduced through the battle, adding to the Hurricane's ceiling and boosting general performance.

“IT WAS NOT AS FAST AS THE SPITFIRE, BUT IT MADE UP FOR THIS BY BEING A MORE ROBUST MACHINE”



'I have fought a good fight'

The pilots of 303 Squadron were not exclusively Polish. Two British, one Canadian and one Slovakian also flew with the squadron, alongside one of the most intriguing characters of the entire war, the Czech pilot Josef František. Unable to control his instincts when in the air, he would leave his formation shortly after take-off and head for the Channel, where he would wait, alone, to ambush returning German planes after their missions. Perfecting this technique to the level of an art form (the Polish pilots called it the 'František method'), he scored 17 kills in the Battle of Britain to add to ten from the Battle of France, but his mental state gradually unwound due to the intense and unrelenting pressure and he eventually died in tragically needless circumstances, crashing his plane while executing a victory roll.

The squadron remains most famous, however, for its 37 Polish pilots, nine of whom died in the six weeks the squadron was operational during the battle. During those six weeks, they shot down 126 German planes, the highest total of any squadron in the RAF. No less an authority than Dowding at Fighter Command recognised the tremendous contribution made by the foreign pilots when he said: "Had it not been for the magnificent material contributed by the Polish squadrons and their unsurpassed gallantry, I hesitate to say that the outcome of the battle would have been the same."

The Polish pilots within the RAF had at times appeared to be almost unstoppable. Sergeant Antoni Głowacki, of 501 Squadron, downed five German planes on 28 August, becoming an 'ace in a day', while 303 Squadron's Witold Urbanowicz was known as the 'ace of aces', once shooting down nine German planes in three

**MESSERSCHMITT BF 109**

THE GERMANS' PREMIER FIGHTER IN THE BATTLE OF BRITAIN WAS A SUPERB ALL-ROUNDER AND A WORTHY OPPONENT FOR THE HURRICANE AND SPITFIRE

The Messerschmitt Bf 109 could make a credible claim to being the best fighter in the Battle of Britain.

The superior armament of the 109 (a pair of 20mm cannons were teamed with two 7.9mm machine-guns) gave them a hefty punch, while they enjoyed significant performance advantages over both Hurricanes and Spitfires at higher altitudes. Richard Overy has claimed that "if the Battle of Britain had been fought at 30,000 feet, the RAF would have lost it."

The 109 also benefitted from extensive armour, added prior to the Battle of Britain, which protected the pilot, but it could not turn as tightly as the British fighters and the Germans also suffered badly in the logistical department;

damaged planes often had to be returned to Germany for repair and aircraft production never hit targets. Only 775 109s were produced during the critical four-month period from June to September 1940.

"THE MESSERSCHMITT BF 109 COULD MAKE A CREDIBLE CLAIM TO BEING THE BEST FIGHTER IN THE BATTLE OF BRITAIN"

days of action at the end of September. He finished with 15 victories to become the most successful Polish pilot of the Battle of Britain.

Although the battle was not to officially end until 30 October, 303 Squadron's contribution came to a conclusion on the 11th of that month when the exhausted men were moved to RAF Leconfield for some badly needed respite. The proud squadron became a training unit for a

while, but its war was not over. It returned to action in 1941, this time in Spitfires.

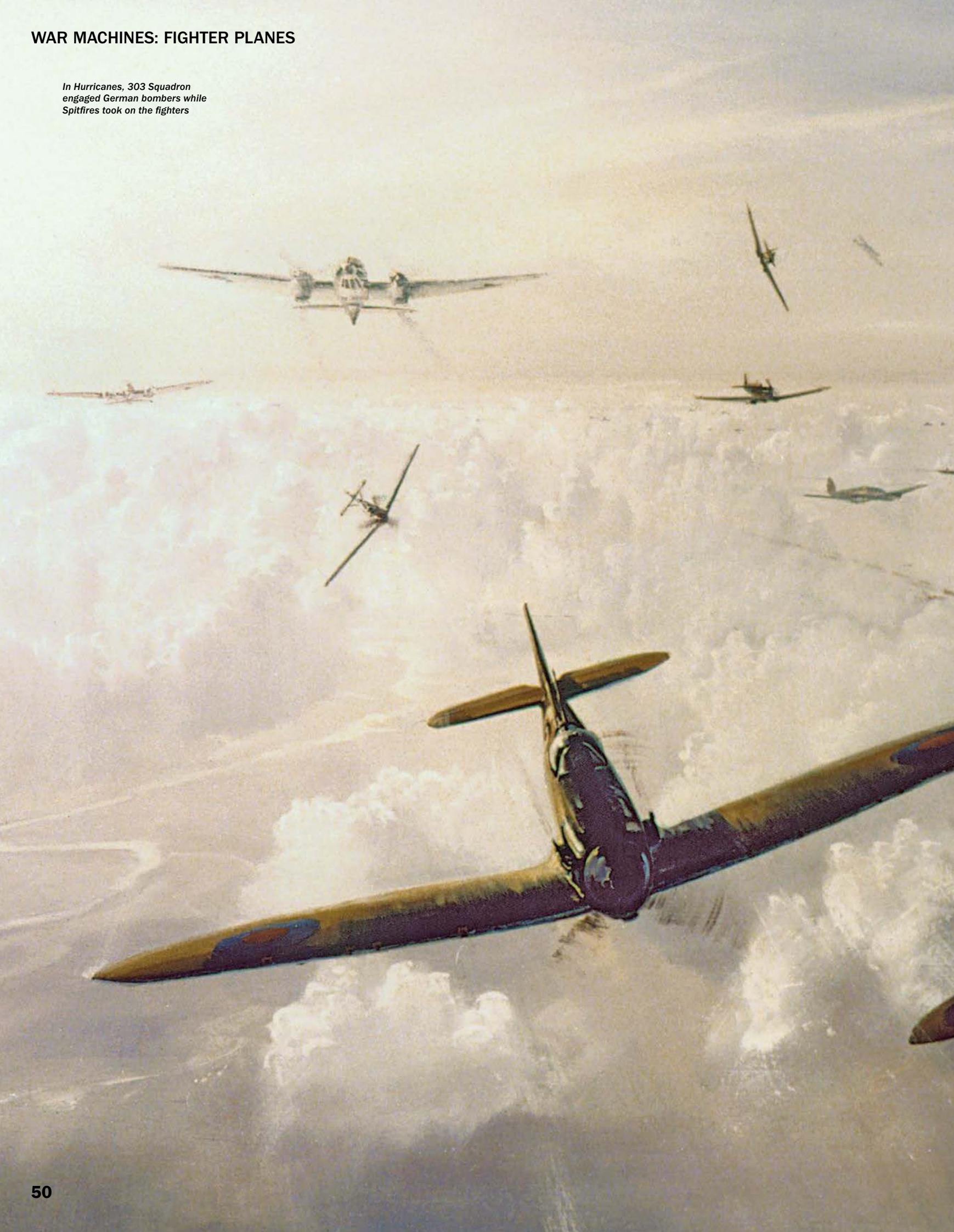
The memorial to the Polish airmen who fought during World War II was unveiled at RAF Northolt in 1948, carrying the names of the 2,408 men who gave their lives and bearing a simple but poignant inscription: "I have fought a good fight, I have finished my course, I have kept the faith."

Front row from left, Polish flying ace Jan Zumbach, Wing Commander Stefan Witorzenc and Flight Lieutenant Zygmunt Bienkowski of 303 Squadron



WAR MACHINES: FIGHTER PLANES

*In Hurricanes, 303 Squadron
engaged German bombers while
Spitfires took on the fighters*



**"HAD IT NOT BEEN FOR THE MAGNIFICENT MATERIAL
CONTRIBUTED BY THE POLISH SQUADRONS AND THEIR
UNSURPASSED GALLANTRY, I HESITATE TO SAY THAT THE
OUTCOME OF THE BATTLE WOULD HAVE BEEN THE SAME"**

AIR CHIEF MARSHAL HUGH DOWDING



Images: Alamy, Getty, Mark Postlethwaite, Topfoto

SPITFIRE

WORDS JACK GRIFFITHS

The two-seater version of a TR9, this Spitfire helped train future pilots for the perils of airborne warfare



The Spitfire is almost ubiquitous when discussing Britain's war in the skies during War World II. There were 22 different versions of the classic interceptor fighter built during the height of its time in the RAF. One of these was the SM520, a two-seater based on the TR9 model, which itself came from a Spitfire Mk IX.

The conversion from one to two seats was a post-war program, with the first SM520 arriving in 1948. The project helped provide flight and gunnery practise for new recruits to the RAF, such as the Irish Air Corps (IAC) Seafire fleet and many other air forces in what was to become the Commonwealth of Nations.

This particular model was constructed as a one-seater TR9 in a West Bromwich factory and was first delivered to the RAF in November

1944. As the war came to an end, the fighter was part of the mass RAF disarmament measures and sold to the South African Air Force (SAAF) for £2,000.

In Africa, it helped train pilots who were to be sent to the conflict in Korea and prepared them for flying in the American-made SAAF P-51 Mustangs. After a series of changes in ownership, the single-seat SM520 was converted to a two-seater in 2002, renamed G-ILDA (after a previous owner's granddaughter) and passed on to the Boulton Flight Academy, where it is currently located.

The original British paint scheme was revived and it is now in a camouflage grey/green scheme as seen on the European Standard Day Fighters that helped Britain defend its borders in its hour of need.

"AS THE WAR CAME TO AN END, THE FIGHTER WAS PART OF THE MASS RAF DISARMAMENT MEASURES AND SOLD TO THE SOUTH AFRICAN AIR FORCE (SAAF) FOR £2,000"

SM520

The enduring Spitfire design means it is the only Allied fighter built during the war that was used until the 1950s. More than 20,000 were built in total

This MK Ila P7350 is the only Spitfire that fought in the Battle of Britain and is still airworthy

SM520 owned by the Boulton Flight Academy



SPITFIRE SM520

YEARS BUILT 1948-51
LENGTH 9.58M (31FT 5IN)
WINGSPAN 11.23M (36FT 10IN)
MAXIMUM SPEED 644KM/H (400MPH)
RANGE 724KM (450 MILES)
ENGINE ROLLS-ROYCE / PACKARD MERLIN 266
CREW 2 (STUDENT AND INSTRUCTOR)
ARMAMENT 2 x .303 BROWNING MACHINE GUNS

Pilots of the 611 West Lancashire Squadron launching a Spitfire off Biggin Hill Airport in 1942



COCKPIT

The aircraft that embodies the spirit and resolve of the British in the summer of 1940 is remarkably easy to pilot. Simple to start, the Merlin engine nearly always fired after two blades and was very reliable with each and every cockpit virtually identical and compact. Pilots past and present have commented favourably on its ease of handling as well as the iconic sound of its engine. As with many aircraft of the era, the Spitfire became harder to control when it neared its top speed. However, its light control column allowed it to be more manoeuvrable than its rival, the Messerschmitt Bf 109. During the Battle of Britain. It would often turn out of dives much quicker than its German equivalent. Without powered controls, these turns were achieved by the strength of the pilot's muscles alone.



The cockpit of the SM520 is authentic, down to the spade-like control column and the throttle control on the sidewall



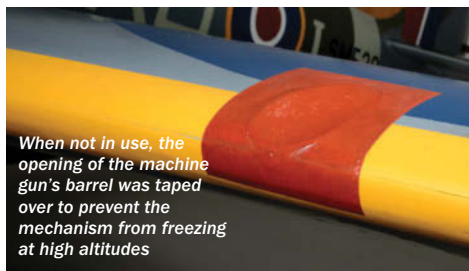
Unlike the Messerschmitt, the Spitfire never took to the use of cannon and relied on its dual machine guns

BROWNING ARMAMENT

During the summer of 1940, the RAF had a foolproof plan against the oncoming Luftwaffe. The Hurricanes would go after the German

Junker 87 and 88 bombers while the Spitfires would face off against the fighters. This decision was tailor made for the RAF aircraft, as the guns on the Spitfire were positioned narrower than those on the Hurricane, making it easier to engage the Messerschmitt fighters.

At its full capacity, the Spitfire could have eight Browning machine guns each containing 300 bullets. This sheer amount of ammo at a pilot's disposal meant even those with poor aim could at least hit something. These projectiles ranged from standard to tracer and incendiary to armour-piercing. The incendiary rounds in particular were very effective, as the RAF pilots targeted the fuel tanks of the Luftwaffe and blew Messerschmitts out of the sky.



When not in use, the opening of the machine gun's barrel was taped over to prevent the mechanism from freezing at high altitudes

THE MESSERSCHMITT BF 109

INSIDE THE SCOURGE OF THE SPITFIRE AND THE LUFTWAFFE'S BACKBONE

Fresh from its preparation in the Condor Legion in the Spanish Civil War, the Luftwaffe's Messerschmitts were ready to take the battle to the British over the Channel. 33,000 were made in total during the war and it provided the spine of the Luftwaffe fleet. Unlike the Spitfire, the Messerschmitt only had two machine guns but these contained magazines of 1,000 rounds each.

Serving across all fronts and in all theatres, the Bf 109 was integral to the Nazi war machine

They also had two 20mm cannons, which were useful against bombers but struggled to cope with the manoeuvrability of Spitfires and Hurricanes. Its main Achilles' heel was its short range, which prevented it from doing more damage across the Channel. Despite its loss in the Battle of Britain, the Bf 109 shot down the most Allied planes in the war and the design was taken on in 1947 by the new state of Israel. Its longevity was down to its simple and direct design and it was still frequently used even in the later years of the war when the jet-powered Me 262 came into production.



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EMBLEMS AND DESIGN

With its origins in World War I, the RAF roundel was used to identify British planes from the ground and in the heat of a dogfight. The Union Flag was initially put forward but due to its likeness to the German cross, the roundel was incorporated.

The first Spitfires were painted brown and dark green while the underside fuselage was white to allow for easy identification by anti-aircraft guns and reduce friendly fire. As the fight against the Luftwaffe began to spread to the Channel, the paint scheme changed from

brown to grey as the new colour blended in with the dark sea.

This colour scheme was employed from then on with the odd variation. These included pink or dark blue for reconnaissance missions at low and high levels respectively and light brown for Middle East missions. Even the roundel was dropped, as in operations over Japan it was deemed too similar to the red disk Hinomaru emblem of the Japanese Zeros.

On the SM520, part of the engine has been moved to make way for the second cockpit in a modern redesign



Above: After the Battle of Britain, the Spitfire took on more of a reconnaissance role and was even occasionally painted pink to add to its camouflage

© John M. Dibbs

Prince Harry is flown in the back of Boulton's Spitfire SM520 over the Needles in the Isle of Wight

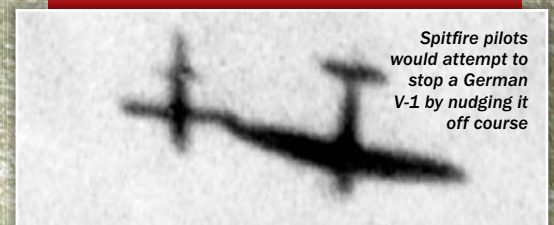
“PILOTS PAST AND PRESENT HAVE COMMENTED FAVOURABLY ON ITS EASE OF HANDLING AS WELL AS THE ICONIC SOUND OF ITS ENGINE”



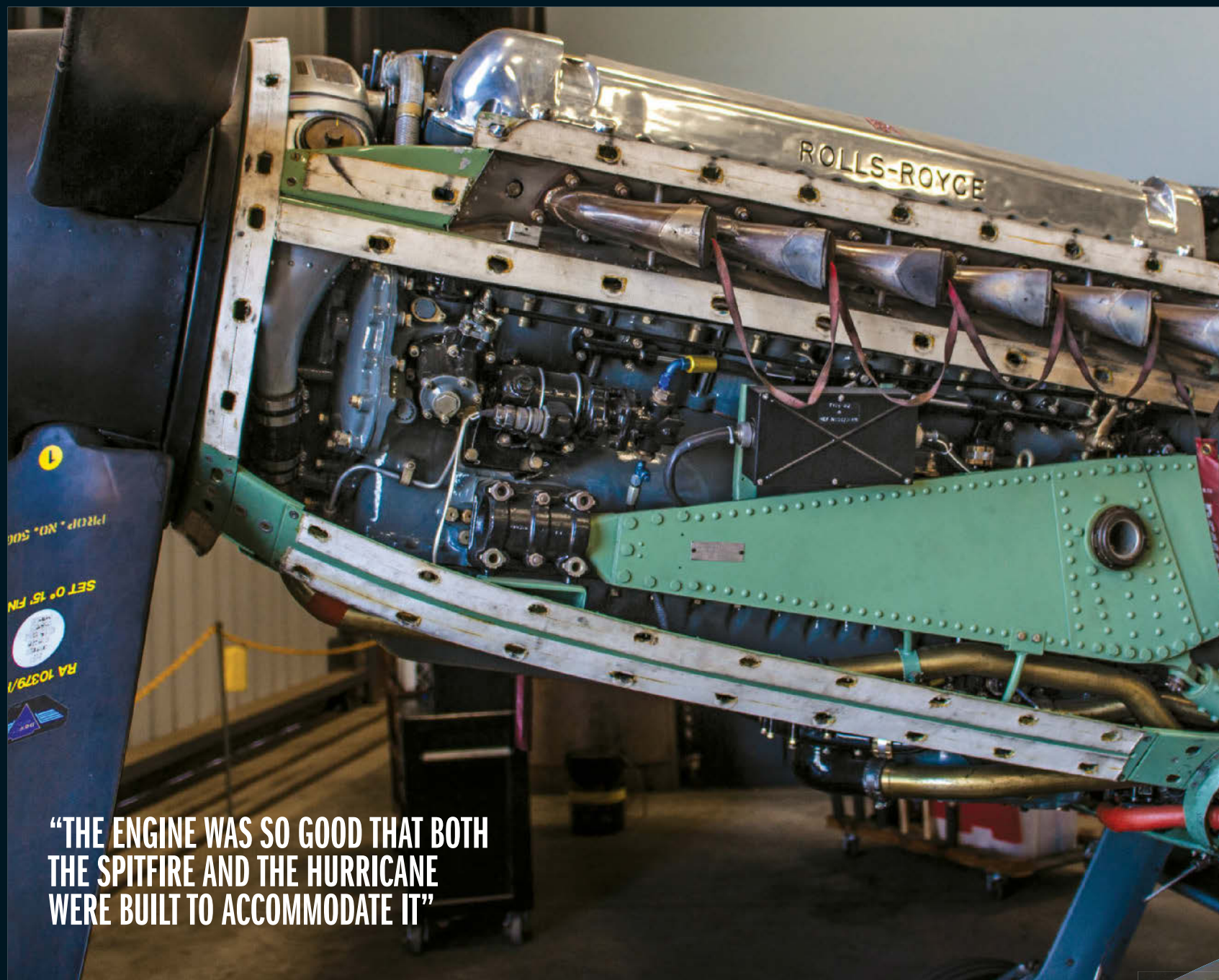
ADLERTAG

On 13 August 1940, better known as Adlertag or 'Eagle Day', the Luftwaffe appeared over the skies of Kent and Sussex, beginning the Battle of Britain. The Spitfire is famous for Britain's resounding victory, but in the following months and years the RAF and the Luftwaffe jostled for air supremacy.

The constantly updated Messerschmitts actually began to outperform the Spitfire by 1941, but the British clawed back the advantage with the development of the better and faster engines in the Spitfire IX. With this new power system, the Spitfires and Seafires had a much broader role in the RAF and Royal Navy. The improved models could now take down V-1 rockets before they hit their target, saving many lives and cities in southern England.



Spitfire pilots would attempt to stop a German V-1 by nudging it off course



**"THE ENGINE WAS SO GOOD THAT BOTH
THE SPITFIRE AND THE HURRICANE
WERE BUILT TO ACCOMMODATE IT"**

SPITFIRE VS HURRICANE

**WHICH BATTLE OF BRITAIN MACHINE
WAS THE SUPERIOR FIGHTER CRAFT?**



The engine was a good all-rounder and was also used in Lancaster bombers, Hurricanes and the USAAF P51 Mustang



THE MERLIN ENGINE

THE POWERHOUSE BEHIND THE SPITFIRE'S ICONIC SOUND

Despite being used in more than 40 aircraft during World War II, the Merlin is most commonly associated with the Spitfire. Named after the bird of prey, the engine first took to the skies in February 1935 and was a marked improvement on the previous Rolls Royce instalment, the Kestrel.

The engine was so good that both the Spitfire and the Hurricane were built to accommodate it. As efficient as it was, the Merlin wasn't without its faults. Unlike the

engines of German Messerschmitts, the Merlin wasn't fuel-injected, so there was a danger of it cutting out in steep dives.

However, this was mostly fixed in 1941 by the addition of a new diaphragm in the engine's float chamber. This was affectionately known as the 'Miss Shilling's Orifice' after its designer Tilly Shilling. Even after World War II the Merlin was still in assembly, and production only ceased in 1950 after 150,000 had been made to help Britain win the war.

"THE CONSTANTLY UPDATED MESSERSCHMITTS ACTUALLY BEGAN TO OUTPERFORM THE SPITFIRE BY 1941, BUT THE BRITISH CLAWED BACK THE ADVANTAGE"



The Spitfire was very nearly called the 'Shrew', which wouldn't have been quite as intimidating



SUPERMARINE SPITFIRE

- ★ MAXIMUM SPEED 608KM/H (378MPH)
- RATE OF CLIMB 812M (2,665FT) PER MIN
- CEILING 10,668M (35,000FT)
- ★ ARMAMENT 2 x 20MM HISPANO MK II CANNONS
- 4 x .303 CAL BROWNING MACHINE GUNS
- 2 x 240LB BOMBS
- ★ LONGEVITY 1938-48 (20,351 MADE)



HAWKER HURRICANE

- 547KM/H (340MPH) MAXIMUM SPEED
- 847M (2,780FT) PER MIN RATE OF CLIMB ★
- 10,972M (36,000FT) CEILING ★
- ★ ARMAMENT 4 x 20MM HISPANO MK II CANNONS
- 2 x 250LB BOMBS OR
- 1 x 500LB BOMB
- 1937-44 (14,583 MADE) LONGEVITY



The Hawker Hurricane served in all major theatres of World War II

SEPECAT JAGUAR

WORDS JACK GRIFFITHS

Climb inside the supersonic ground-attack aircraft that served air forces from all over the world for nearly 40 years

A twin-engine, single-seat jet aircraft, the Jaguar was a joint British and French project to create a supersonic strike fighter/bomber. Developed by SEPECAT, a union of Breguet Aviation and the British Aircraft Corporation, it was the first combined effort to create a combat aircraft by two major European powers. After its first flight on 23 March 1969, 588 were made. It proved immensely popular for other air forces, with the Indian Air Force (IAF) buying 40 in 1978 in a \$1 billion (£664 million) deal. Their lead was followed by the air forces of Ecuador, Oman and Nigeria, who also bought models to bolster their air forces.

There have been many variants of the Jaguar since its inception. The Jaguar A was the first of the breed but it was followed by new and

improved versions such as the M, which was a navy version with unique landing gear and a reinforced airframe.

The Jaguar initially had a limited attack capability but this was soon changed to more advanced roles such as reconnaissance and even tactical nuclear strikes. The jet was devised to replace the rapidly ageing McDonnell Douglas Phantom FGR2 and remained in service for a long period – it was only retired by the French Air Force in 2005 and by the RAF in April 2007. The Jaguar remains effective in modern air combat and is still in use in the IAF. Its combat history is impressive, with the Jaguar having served across the globe in the Gulf War, Balkan Wars, Kosovo War, Kargil War and Cenepa War.

The SEPECAT Jaguar made its first flight in 1969 and was so popular that it is still used by the Indian Air Force today



“THE JAGUAR INITIALLY HAD A LIMITED ATTACK CAPABILITY. THIS WAS SOON CHANGED TO MORE ADVANCED ROLES SUCH AS RECONNAISSANCE, ATTACK AND EVEN TACTICAL NUCLEAR STRIKES”

SEPECAT Jaguars flying in formation on 29 March 1974



SEPECAT JAGUAR GR1 XX763

MAIDEN FLIGHT 1975

ORIGIN UK/FRANCE

LENGTH 16.84M (55.3FT)

WINGSPAN 8.69M (28.6FT)

RANGE 535KM (335 MILES)

ENGINE 2 X ROLLS ROYCE TURBOMECA ADOUR MK 104

SPEED 1,593KM/H (1,055MPH)

CREW 1

PRIMARY WEAPON ANTI-RADAR AIR-TO-SURFACE MISSILES, AIR-TO-AIR ROCKETS, GUIDED BOMBS

SECONDARY WEAPON 2 X 30MM ADEN CANNON

The Jaguar could really pack a punch, with weaponry from Matra AS37 anti-radar missiles to AIM-9 Sidewinders

WEAPONS

The Jaguar was a force to be reckoned with in combat. Fitted with two rapid-fire 30mm DEFA cannons, the fighter-bomber could strafe and damage ground targets even before it unloaded its missiles. With 4,500-kilogram (9,921 pounds) worth of payload available to the pilot, a variety of armaments can be carried. The Jaguar's speciality was in anti-radar. Most models were equipped with laser-guided Martel missiles and Rockeye cluster bombs to take out ground targets while Sidewinders took care of anything else in the air. Finally, the Jaguar also had the capacity to carry an AN-52 nuclear warhead, representing the trust placed in the machine by its operators.

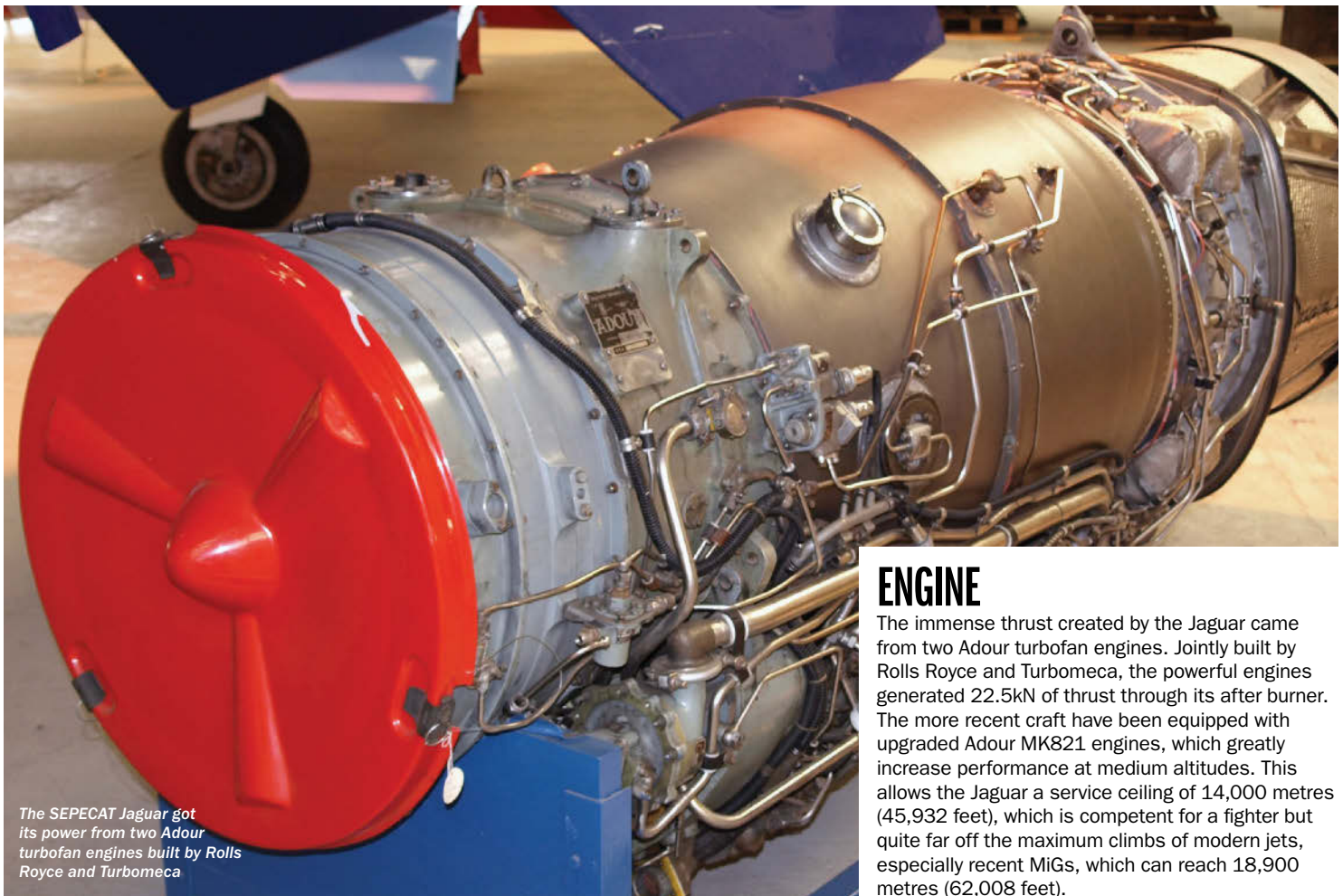


Missiles and rockets would be released from the side of the aircraft and it could only be seconds until a vehicle or building was laid to waste



Most SEPECAT Jaguar models were armed with laser-guided missiles





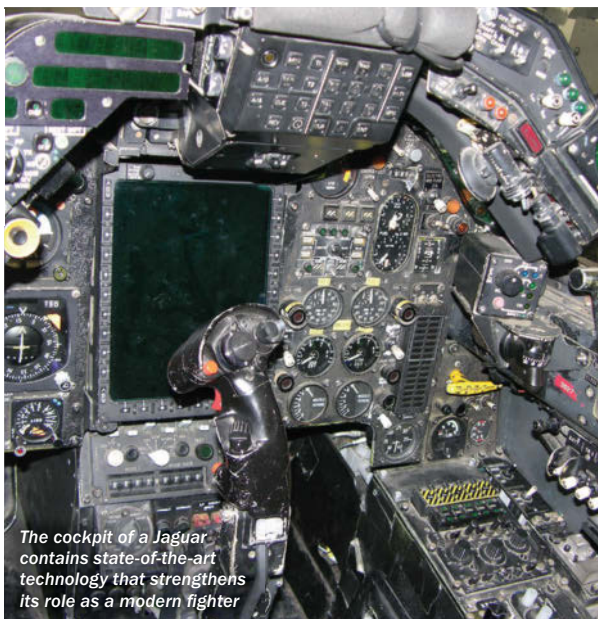
The SEPECAT Jaguar got its power from two Adour turbofan engines built by Rolls Royce and Turbomeca

ENGINE

The immense thrust created by the Jaguar came from two Adour turbofan engines. Jointly built by Rolls Royce and Turbomeca, the powerful engines generated 22.5kN of thrust through its after burner. The more recent craft have been equipped with upgraded Adour MK821 engines, which greatly increase performance at medium altitudes. This allows the Jaguar a service ceiling of 14,000 metres (45,932 feet), which is competent for a fighter but quite far off the maximum climbs of modern jets, especially recent MiGs, which can reach 18,900 metres (62,008 feet).

COCKPIT

The control centre of the aircraft, the cockpit of a Jaguar utilised cutting-edge technology for the time. The all-digital cockpit included multi-functional displays with built-in night vision and GPS. This was accompanied by a helmet-mounted display, radar altimeters, navigation systems, automatic direction finder, a weapon-aiming computer and information that helped the pilot distinguish friend from foe. The Navigation And Weapon-Aiming Sub System even allowed the Jaguar to attack enemies without the use of radar.



The cockpit of a Jaguar contains state-of-the-art technology that strengthens its role as a modern fighter

20TH-CENTURY SUPERSONIC FIGHTERS

WHAT WERE THE JAGUAR'S RIVALS FOR AIR SUPERIORITY?

MIG-25

Known as the Foxbat, the MiG-25 is just one in a long line of Mikoyan-Guervich fighters. Immensely powerful, the Foxbat could reach Mach 2.8 but was let down by its thirsty fuel tank. It was primarily a reconnaissance aircraft used to spy on US activity, but could also unleash missiles, as it did in the Iran-Iraq War.



F-15 EAGLE

The F-15 was so advanced for its time that it is still in use today. Boasting a max speed of twice the speed of sound, it can also hold a huge payload of armaments. It was the premier fighter for the US in the Gulf War, outclassing its rivals in Operation Desert Storm.



HARRIER JUMP JET

Still the most famous vertical take-off aircraft, the Harrier began life in the RAF in 1969. Its most famous incarnation is the Sea Harrier, which fought with distinction in the Falklands War. The design was ported across Europe to Spain and Italy and it remains in service around the world.



“THE PLANE’S SYSTEMS COME COMPLETE WITH SPOILERS, AIR BRAKES AND A BULLETPROOF WINDSCREEN”

DESIGN

Constructed with an aluminium airframe, the Jaguar can handle extreme weather conditions and speeds of up to 1,593 kilometres per hour (1,055 miles per hour). It is equipped with an in-flight refuelling probe that allows the aircraft to be refuelled mid-air. The plane’s systems come complete with spoilers, air brakes and a bulletproof windscreen. In later models of the Jaguar, Ferranti laser rangefinders and marked-target seekers were added to the nose as part of even more advanced armaments. The aircraft is covered in an all-over wrap-round camouflage that helps the Jaguar avoid detection.



The landing gear’s low-pressure tyres retract into the fuselage on takeoff. The IAF initially reported failures, which led to the system being upgraded

The aerodynamic and streamline design allows the Jaguar to reach speeds of Mach 1.4

“CONSTRUCTED WITH AN ALUMINIUM AIRFRAME, THE JAGUAR CAN HANDLE EXTREME WEATHER CONDITIONS AND SPEEDS OF UP TO 1,593 KILOMETRES PER HOUR”



THE BOURNEMOUTH AVIATION MUSEUM

In August 1999, the Bournemouth Aviation Museum was established on the same site as Bournemouth Airport. Originally part of the now defunct Jet Heritage Museum, the centre strives to provide a hands-on experience for all visitors. The centre has 15 aircraft, ranging from military jets to a Boeing 737. It houses aircraft from all eras such as a Gloster Meteor from 1944 and the SEPECAT Jaguar. Visitors are encouraged to jump in the cockpit and have a go in a truly interactive experience.



JAGUARS IN WAR



INDIA

The biggest non-European customer for the Jaguar used the aircraft extensively in the three-year Indian Peace Keeping Force in Sri Lanka. They were also used to launch laser-guided bombs in the 1999 Kargil War with Pakistan and in an anti-ship role, a function it rarely undertook for the UK and France. They are still in use but there are plans to upgrade them.



UK

The Jaguar was an effective member of the RAF for many years. It undertook the first bombing raid in Europe since World War II against Bosnian Serb forces and also saw action in the Gulf War, designating targets for laser-guided bombs. It was meant to serve in the 2003 Iraq War but was pulled out after Turkey refused the use of its air bases.



FRANCE

The Armée de l'Air (French Air Force) utilised the Jaguar in combat operations in Chad, where they supported the country against Libyan forces. The fighter was involved in various operations such as the raid on Ouadi Doum airstrip and also flew for the country in the Gulf War and Kosovo. Jaguars were effectively replaced by the Dassault Rafale in 2005.

HARRIER

GR9

The final Harrier used by the RAF is a hi-tech aviation powerhouse and an upgrade to one of the finest aircraft designs of all time



One of Britain's most celebrated engineering innovations of the last century, the Harrier's unique design has made it a deadly war machine and a global icon. First appearing in 1957, and followed by many updated versions, by 1980 the line was in need of a shakeup, so the USA and UK agreed on a £184 million (\$280 million) project – the result was the Harrier II. Before its later purchase by the US AV-8B fleet, it served in Kosovo, Iraq and Afghanistan on the Invincible class of aircraft carrier.

An ideal machine for both attack and reconnaissance missions, the Harrier II was deployed frequently by NATO to deter violence

after the collapse of Yugoslavia. Later in its life span, the aircraft was joined by Sea Harriers in a new line-up known as Joint Force Harrier.

During the Invasion of Iraq, the British action worked under Operation Telic and at the Battle of Basra. Here, Harriers destroyed many Scud missile launchers and fuel depots using the effective AG-65 air-to-ground Maverick missile. The last aircraft of this type to see service in the Royal Navy was the GR9, which is still in service in the United States Marine Corps.

First coming into service in October 2006, it is an update of the GR7 and boasts advanced precision weaponry, new communications and airframe upgrades. The model at Fleet

Air Arm Museum is the ZD433, which was delivered on 20 December 2011. Today it is affectionately known as 'Dirty Harry' and has been maintained in the same condition as when it served.

BRITISH AEROSPACE HARRIER II GR9

FIRST MANUFACTURED 2006

ORIGIN UK

LENGTH 14.36m (47ft)

ENGINE RR Pegasus 105 turbofan

MAXIMUM SPEED 574 knots (660mph)

THRUST 21,750lbs

MAX ALTITUDE 13,106m (43,000ft)

CREW 1

ARMAMENT AIM-9L Sidewinder,
Maverick, Paveway II, Paveway
III, Enhanced Paveway, General
Purpose Bombs, CRV-7 rocket pod



The inside of a Harrier II cockpit as it's about to take off from HMS Ark Royal in 2010

"THE HARRIER'S UNIQUE DESIGN HAS MADE IT A DEADLY WAR MACHINE AND A GLOBAL ICON"

"AN ULTRA-EFFECTIVE AIR-TO-AIR MISSILE, THE SIDEWINDER IS RIGHT AT HOME WITH THE HARRIER'S ADVANCED TECHNOLOGY, UTILISING THE ONBOARD ACTIVE INFRARED GUIDANCE SYSTEM"



A Harrier GR9 in flight with a full payload of missiles

ARMAMENT

In 2004, BAE Systems was awarded a £100 million (\$151 million) contract to develop the weapons on the GR9 to help it perform its attack duties. Taking inspiration from the Sea Harriers that served the British so admirably in the Falklands, the preferred weapon of the Harrier II is the supersonic heat-seeking AIM-9 Sidewinder. An ultra-effective air-to-air missile, the Sidewinder is right at home with the Harrier's advanced technology, utilising the onboard active infrared guidance system. Targets on the ground are also at risk from the GR9, as it comes equipped with Paveway or Maverick bombs that can destroy a large surface area or important objectives with blast, penetration and fragmentation. Unlike many attack aircraft, the GR9 is not armed with a machine gun but does incorporate a Brimstone anti-armour system and a pod of CR7 rockets.



The aircraft's pod rockets next to the auxiliary fuel tank



The unguided pod rockets are a mainstay of the Harrier II's armoury and are frequently used when missiles aren't available



As the control system is so advanced, the GR9 is easier to fly than its predecessors

DESIGN

The wings on a Harrier II span 9.25 metres (30.33 feet), a 14 per cent increase in area on earlier models. The thicker wings and their leading edge root extensions also allow a much higher payload than before – 3,035 kilograms (6,700 pounds) more can be carried as long as the Harrier is allowed a 300-metre (1,000-foot) takeoff. The extra weight is made up of an added missile pylon plus a strengthening of the leading edges of the wings to combat bird strikes, which have caused more issues in the past than you would probably think.

“THE AIRCRAFT ALSO HAS A TARGETING POD THAT USES THERMAL IMAGING AND A LASER DESIGNATOR TO IDENTIFY HOSTILES ON THE GROUND”



The bubble canopy gives the pilot excellent 360-degree views so they can easily see if an enemy is on their six

COCKPIT

The GR9's cockpit is packed full of technology with a heads-up display (HUD), multipurpose colour displays (MPCDs) and an inertial navigation system (INS), all designed to aid the pilot on missions. Like the majority of fighter aircraft, many of the jet's features are controlled by a standard hands on throttle and stick (HOTAS) lever. Night-vision goggles come as standard and the aircraft also has a targeting pod that uses thermal imaging and a laser designator to identify hostiles on the ground when in difficult terrain or challenging weather conditions. The resulting image can even be ported via downlink to ground troops and vehicles to aid them on the same mission. Unlike in the UK, the US version of the GR9 is still up and running and future plans include installing a ground proximity warning system.

THE ORIGINAL HARRIER THE REVOLUTION THAT WAS THE HAWKER SIDDELEY P.1127

In the 1950s, the idea of a fixed-wing aircraft that could achieve vertical takeoff was being investigated by the superpowers. Early prototypes like the American Lockheed XFV-1 fell by the wayside until the first Harrier came around in 1957 and changed everything. Only an experimental plane itself, it nevertheless led the way for a new breed of aircraft. Despite having critics early on (it was originally ridiculed for being a subsonic aircraft in the supersonic age), the first Harrier impressed with its innovative VSTOL (vertical and/or short take-off and landing) capabilities that were a precursor for the popular future VTOL (vertical take-off and landing) system in later versions of the craft. The hovering was achieved by thrust vectoring through rotating engine exhaust nozzles aimed at a 90-degree angle. It was powered by a Rolls-Royce 101 turbofan engine and was labelled as a single-seat close-support and reconnaissance fighter.

The prototype evolved into the British Harrier GR MK1, which entered service on 1 April 1969. It was later exported to the USA and renamed the AV-8A as it replaced the F-4 Phantom. It has had a series of updates since and the fighter is commonly remembered for its achievements in the Falklands War, when it downed 20 Argentine jets on 1,190 sorties with no air-to-air losses of its own.



The AV-8S Harrier, one of the later developments that spawned from the iconic Hawker Siddeley P.1127

ROLLS-ROYCE PEGASUS ENGINE

The GR9 is powered by a Rolls-Royce Pegasus vectored-thrust turbofan engine. This model of the Harrier is fitted with a mk105 engine while the GR9A Harriers have the slightly upgraded mk107, which provides a huge 23,400lb of thrust. The mk107 is so powerful that in the rear fuselage section only metal able to withstand extremely high levels of fatigue can be used. The metal is usually a composite, which also helps with weight reduction to give the GR9 even more range. The materials used on this modern aircraft are a huge improvement on the aluminium alloy fuselage used on earlier models.

The Pegasus engine is specifically designed to allow for the Harrier's hovering capabilities. The secret is in rotating nozzles and airflow management



The GR9 boasts an excellent aerodynamic design. The tailplane, for example, can be controlled to become more streamlined by hydraulic jacks

"THE MATERIALS USED ON THIS MODERN AIRCRAFT ARE A HUGE IMPROVEMENT ON THE ALUMINIUM ALLOY FUSELAGE"

Our Senior Staff Writer Jack got a hands-on experience with the Harrier at Fleet Air Arm Museum



THE ROAD TO THE GR9

A CRASH COURSE ON THE OTHER MAJOR VARIANTS OF THE HARRIER II

GR5

The first model of the second-generation Harrier, the GR5 updated the avionics and armaments that were featured on the previous incarnation of the aircraft. An important step in the aircraft's evolution, a short-lived GR5A was also made before the next upgrade.



GR7

Next on the production line was the GR7, which had its maiden flight in May 1990. Now with night-time operational capabilities, the GR7 and GR7A had improved thrust and electrical systems and could carry a greater payload.



T10

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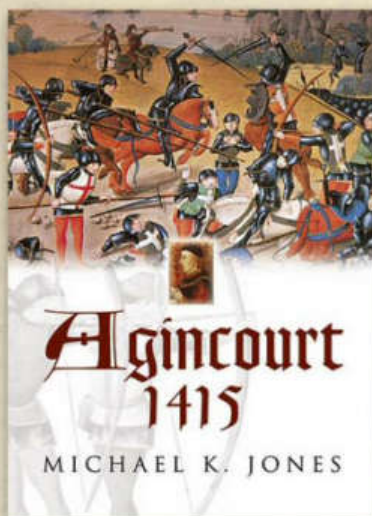
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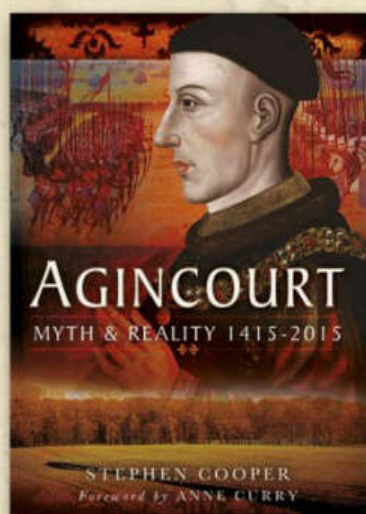
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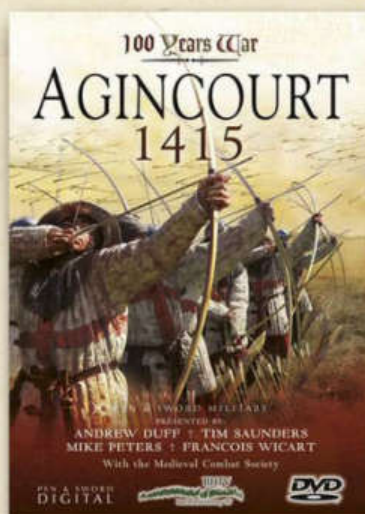
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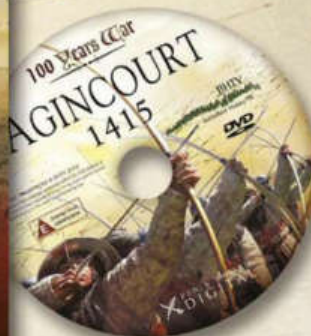
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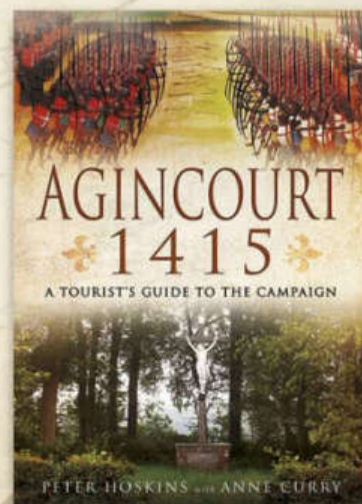
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